Trinity Academy St Edwards

Noise Impact Assessment

0051161

24 November 2021

Revision P01

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Glossary

Term	Definition
Ambient noise (as defined in BS 4142)	Totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.
Background Noise (as defined in BS 4142)	A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.
Rating Noise Level (as defined in BS 4142	The specific noise level plus any adjustment for the characteristic features of the noise.
Specific Noise Level (as defined in BS 4142)	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
$L_{Aeq,T}$	Equivalent continuous sound pressure level (A-weighted) over a period of time, T. (Ambient noise level)
$L_{A90,T}$	Sound pressure level (A-weighted) exceeded for 90% of the measurement period. Referred to as background noise level.
Decibel, dB	Commonly used unit used for the comparison of the powers of levels sound. Abbreviation dB. For sound pressure level (L_p) the reference quantity is 2x10-5 N/m^2. The sound pressure level existing when microphone measured pressure is 2x10-5 N/m^2 is 0 dB, the threshold of hearing.
L_{eq} (& L_{Aeq})- Equivalent continuous noise level of a time-varying noise	Steady noise level (usually in dB(A)) which, over the period of time under consideration, contains the same amount of sound energy as the time-varying noise over the same period of time.
L_p - sound pressure level	Sound pressure level, in decibels, of a sound is 20 times the logarithm to the base of 10 of the ratio of the sound pressure to the reference pressure. The reference pressure shall be explicitly stated and is defined by standard.
$L_{Fmax,T}$ (& $L_{AFmax,T}$)	The maximum sound pressure level measured during the measurement period T using the fast time constant.
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
C_{tr}	Spectrum adaptation term calculated using traffic noise as described in ISO 717-1:1996. This term is provided with weighted single values such as $D_{nT,w}$ or R_w to match with particular requirements (building acoustic or traffic noise spectrum).
Statistical noise levels	Noise levels that vary greatly over time are usually expressed using statistical values of the level exceeded for a stated percentage of the time. These are denoted Lx, showing the level that is exceeded x% of the time. L_{A90} is considered to be the (A-weighted) background noise level with unusually loud events being excluded. L_{A10} is usually used for the measurement of traffic noise.
Weightings (as defined in IEC 61672:2003):	A-Weighting: Frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.). C-Weighting: One of the frequency weightings corresponding to the 100-phon contour and the closest to the linear or un-weighted value.

1 Introduction

Buro Happold have been appointed by Bowmer+Kirkland Ltd. to carry out a Noise Impact Assessment in support of a planning application for the proposed Trinity Academy St Edwards, Barnsley development.

This report presents the results of the noise survey carried out by Hoare Lea and Waterman Infrastructure & Environment Limited on the proposed site (Barnsley, S70 2EX). The results of this noise survey are taken in good faith as being accurate and valid.

The results of these environmental noise survey will be used by the design team to:

- Assess the existing acoustic environment and potential issues associated with noise
- Determine the current noise levels on-site to assess the possibility of natural ventilation
- Provide information relating to the required minimum acoustic performance of glazing and ventilation systems
- Determine the current background noise levels at the site for assessing the likelihood of disturbance at the nearest noise sensitive receptors (NSRs) due to the operation of newly introduced plant associated with the development.

Buro Happold has provided advice on the above items promoting sustainable design to reduce carbon emissions where possible. This includes an assessment of the suitability of natural ventilation to minimise the reliance on mechanical cooling systems, and therefore providing a greener footprint for the proposed development

1.1 Contents

This report provides commentary on:

- External noise levels (from the survey)
- Façade sound insulation design and feasibility of natural ventilation
- Required maximum permissible noise impact levels for plant/activities
- Noise impact of the proposed MUGA
- Local Planning requirements compliance

1.2 Description of the Proposed Development and Site

The proposed development is a new build school consisting of two blocks, a three-storey main new secondary school building, and a Sports Block and changing facilities as shown in Figure 1—1.

The new school block comprises general teaching classrooms including Science, ICT, Library, Art, RM Workshop, Construction Textiles, Food, Music and Practice rooms.

Ancillary areas include hard landscaping car park to the north and both soft and hard landscaping sports fields in the surrounding area.

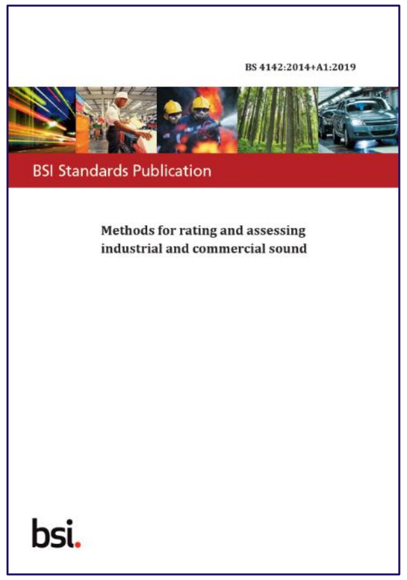
Figure 1—1 Proposed Site Plan (Source: ares Landscape Architect 17.09.2021)

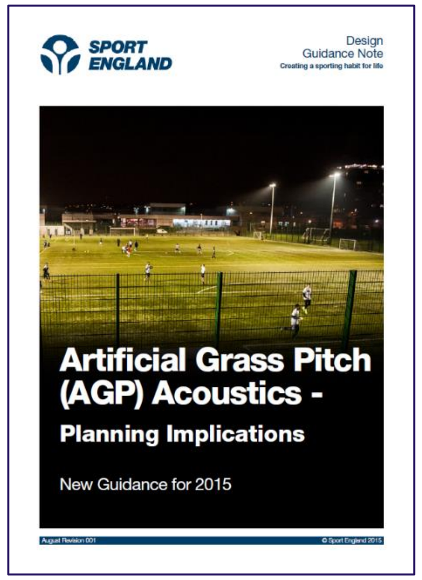
1.3

1.4 Reference Codes and Standards

This acoustic design report refers to the following list of codes and standards:

- **Building Bulleting 93 (BB93):2015** – Acoustic design of schools: performance standards
- **British Standard (BS) 4142: 2014+A1:2019** – Methods for rating and assessing industrial and commercial sound is a standard used primarily for assessing the likelihood of complaints from local residents caused by industrial/commercial sound
- **Institute of Acoustics (IOA) and Association of Noise Consultants (ANC):2015** – Acoustics of Schools: A Design Guide
- **Sport England:** Artificial Grass Pitches Acoustics Planning Implications Guide (August 2015 Revision 001)
- **Barnsley Metropolitan Borough Council** - guidance on the local authority requirements on noise levels





2 Environmental Survey

2.1 Introduction

A noise assessment was carried out by Waterman, to support the planning application for the proposed School titled:

Report Title: Trinity Academy, Barnsley. Noise Assessment. August 2020
Report Reference: WIE1725-106-R-1-1-2

The assessment does not include a sitewide noise survey due to the decreased traffic flows associated with the Covid-19 pandemic and national lockdown. The following excerpt is taken from the report:

> *Since current road traffic flows have been reduced across the U.K. due to the current health crisis associated with Covid-19, noise emissions from local and major road networks have also decreased. As such environmental noise survey data has been referenced from a recent noise impact assessment carried out at an adjacent site prior to the March 2020 lockdown. This report provides recommendations and mitigation measures to provide suitable amenity for the future school occupants and to protect the amenity of nearby existing residents.*

The environmental noise survey being referred to is one undertaken by Hoare Lea in August 2019 for a nearby site. The Waterman report refers to DEFRA noise to supplement the Hoare Lea data and inform the noise assessment for the School.

The results of the survey will be used to capture the existing background noise levels at nearby noise-sensitive (residential dwellings) receptors. This allows the specification of limiting noise levels for any externally located (or external terminations of) services plant to see that the installation will not unduly increase existing noise levels in the vicinity of the site in line with pertinent criteria.

2.2 Site location

The proposed site is located adjacent to A6133 Road, Barnsley, S70 2EX. The proposed development is bounded by:

- Residential dwellings and playing fields to the north
- Locke Primary school to the east
- Two storey residential dwellings and allotments to the east and south
- A6133/Broadway Road to the south and west

Figure 2—1 Proposed Site and NSRs

2.3 Survey Details and Methodology

2.3.1 Hoare Lea Nose Assessment

The measurement locations correspond to Locations 1 and 2 in Figure 2—2 where:

- LT1 (unattended): located on the roof of the fire station approximately 80m from the A6133 motorway
- ST2 (attended): located in the carpark

Only Position 1 noise data will be used as Location 2 noise measurements are understood to have been specific attended measurements of drills at the existing fire station.

2.3.2 Waterman Infrastructure & Environment Limited Noise Assessment

The Noise assessment carried out by Waterman Infrastructure & Environment Limited was obtained via data from Extrium Noise Viewer. The noise maps obtained are based on data from the most recently published versions (2017) by Defra and are based on a 10m grid at a receptor height of 4m above ground (see figures Figure 2—3 to Figure 2—4).

Figure 2—2 Noise measurement locations marked up on aerial site location image

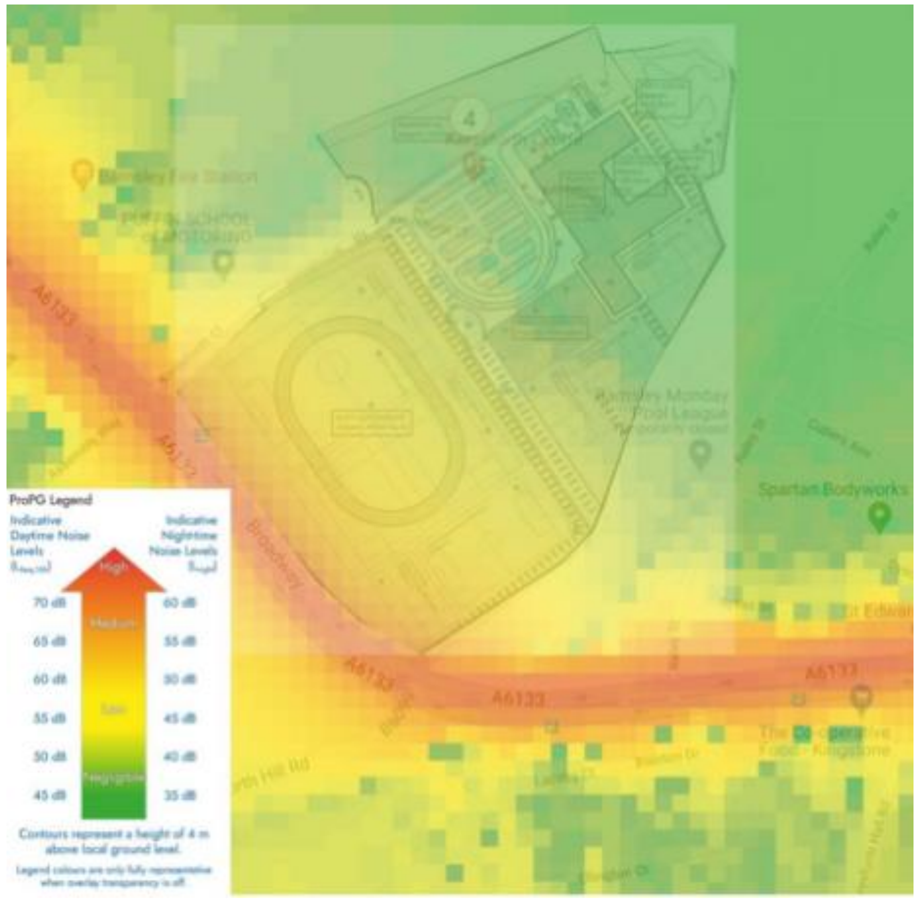


Figure 2—3 Site Suitability Indicator (SSI) model of daytime road traffic noise levels. (Source: Waterman)

2.4 Noise Survey Results

The environmental noise survey carried out by Horea Lea was undertaken between Thursday 8th and Saturday 10th August 2019 and a further Noise assessment was carried out by Waterman Infrastructure & Environment Limited in August 2020. These noise survey results adopted for the purpose of this assessment has been taken in good faith as being accurate and valid.

The definition of the measurement indices are as follows

- **$L_{Aeq,15min}$** – the average A-weighted sound pressure level over a 15-minute period. Typically thought of as the average ambient noise level at a particular time, and likely to be due to a combination of various noise sources, near and far
- **$L_{A90,15min}$** – The A-weighted sound pressure level exceeded for 90% of the measurement period. A level which would be perceived as a constant, background noise level. Typically, largely unaffected by local traffic pass-by or by transient events. More usually attributable to constantly running building services plant or distant road traffic.

The 'design level' values in the tables were derived from the long and short-term measurements undertaken at locations illustrated in Figure 2—2. Each descriptor was calculated as follows:

- **Existing Ambient $L_{Aeq,T}$** – logarithmic average of the measured $L_{Aeq,15minute}$ values, measured during representative daytime periods for the long-term measurements and the short-term measurements and the daytime and night-time periods for the long-term measurement
- **Background $L_{A90,15min}$ -** In the short-term measurements – minimum measured $L_{A90,15minute}$ values, measured during representative, day and night-time periods. In the long-term measurements, the modal or median $L_{A90,15minute}$ value is adopted depending on the repeatability of the modal count.

2.5 Discussion

The assessment made by Hoare Lea shows that noise levels at LT1 are considered to be the most representative of the background noise environment near residential NSR 3 with a median noise level of $L_{A90,T}$ 42dB.

The results have been used to calibrate a 3D acoustic model (described in more detail in the following section), which has been used to assess the suitability of a natural ventilation and façade/glazing specifications for the school

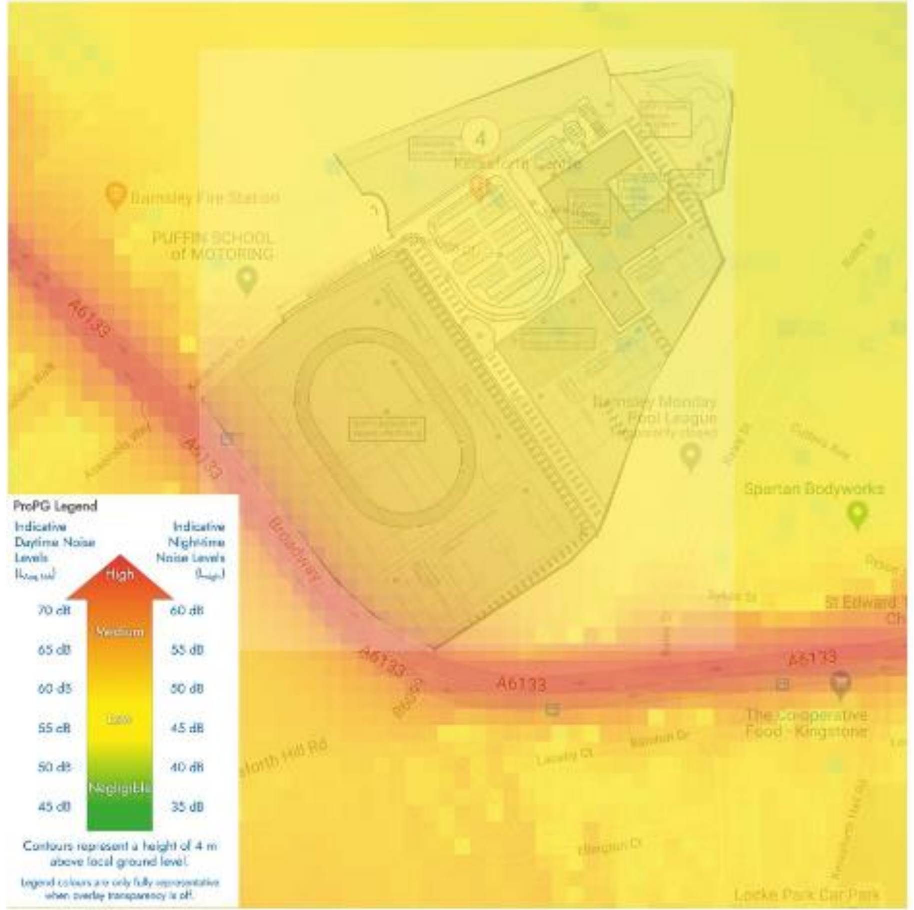


Figure 2—4 Site Suitability Indicator (SSI) model of night time road traffic noise levels mapped. (Source: Waterman)

Table 2—1 Noise survey results from the survey in August 2020 (Source: Waterman Infrastructure & Environment Limited)

Table 4 Results of Hoare Lea Noise Survey

Period	$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A90,T}$
Thursday (11:00 - 23:00)	54.9	63 - 82	40.3
Thursday night	47.9	57 - 85	36.0
Friday	52.9	62 - 82	43.2
Friday night (23:00 – 03:00)	44.8	57 - 61	35.6

3 Modelling

3.1 Introduction

A noise modelling exercise has been undertaken to assess the likely noise levels at the proposed building façades. This information is further used to carry out the façade build-up design in terms of its sound insulation properties. The key outcome of this exercise is the assessment of required ventilation conditions.

3.2 Methodology

The 3D model has been created using CadnaA version 2019 acoustic software. Local roads were added into the model to simulate noise sources that were measured during the on-site noise survey. The noise sources were then calibrated to match the measured noise levels taken across the site to represent the typical noise levels to which the School should be exposed during its hours of operation. The model maps the noise impacts on the proposed façades, considering factors such as distance attenuation, screening, reflections and source directivity. The CadnaA noise grids are calculated at 1.2m height above the relative ground level.

3.3 Limitations

The assessment has been based on the results produced through a noise modelling exercise, which provides predictions on the likely future noise levels. However, this does not guarantee the full accuracy of the predicted noise levels. Typically, an uncertainty within a range of approximately ±3 dB could be expected from computer noise modelling software. However, this uncertainty has been controlled as far as practicable by cross-referencing the levels of predicted noise impact against the measurements captured on site.

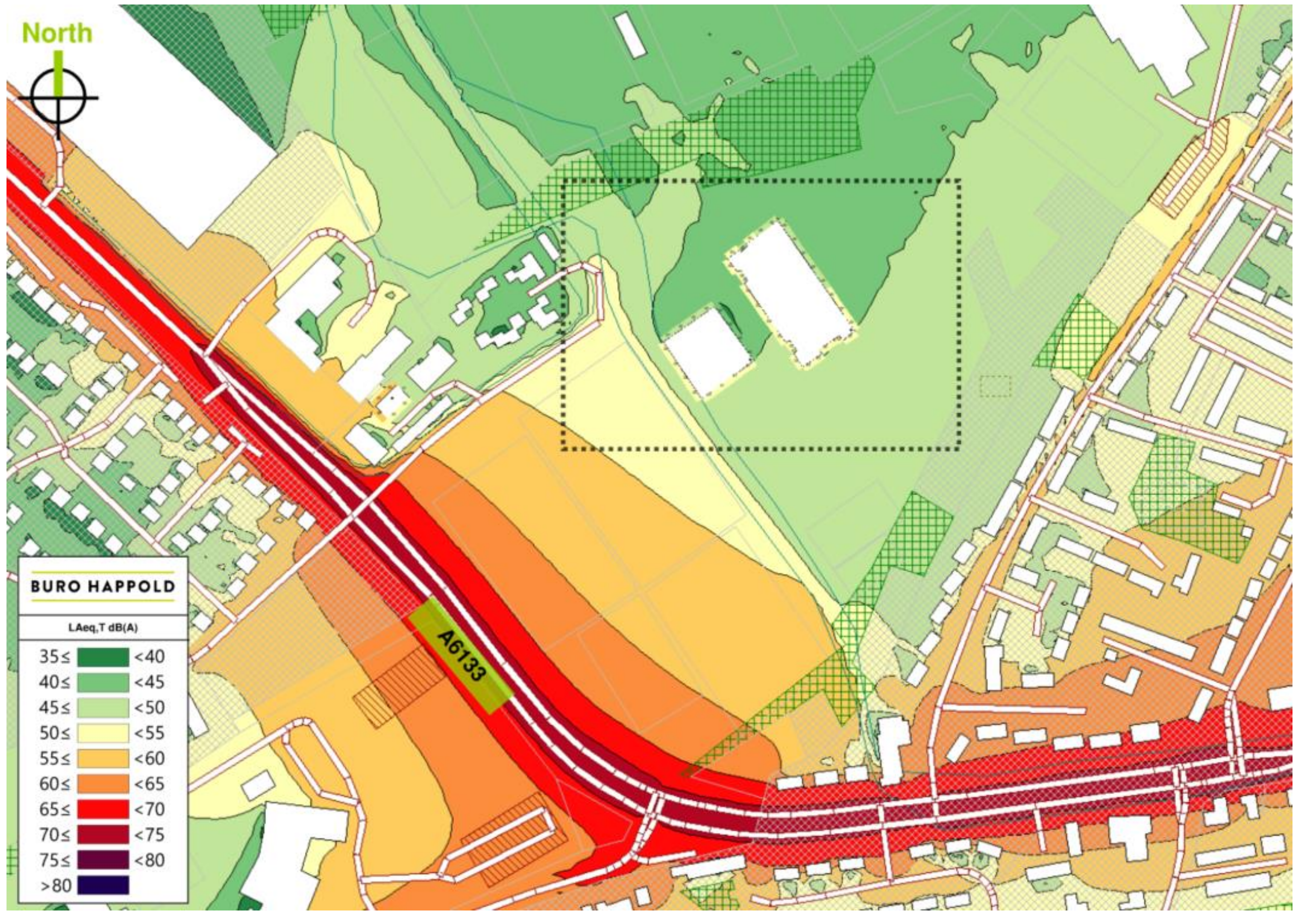


Figure 3—1 Calculated ambient noise levels masterplan, $L_{Aeq,T}$ dB

Figure 3—2 Calculated highest daytime incident ambient noise levels at the façade, $L_{Aeq,T}$ dB

3.4 Results

The images lifted from the 3D acoustic model displayed in Figure 3—1 and Figure 3—2 present the highest predicted ambient noise level ($L_{Aeq,T}$ dB) across each of the proposed school buildings, regardless of height. Figure 3—3 and Figure 3—4 present 3D graphical representation of how the predicted ambient noise levels vary across the different façade.

3.5 Discussion

As can be seen from the noise modelling exercise, the elevations of the proposed school buildings are subject to a variable level of noise impact.

The model shows that the greatest level of noise impact is that of A6133/Broadway Road on the west and south façades of the proposed school block, with noise levels up to $L_{Aeq,T}$ 55 dB on the second floor. An analysis will be provided in the following sections to determine the impact of these levels on the noise break-in regarding ventilation and glazing.

Figure 3—3 3D representation of predicted daytime façade incident ambient noise levels from the south façades, $L_{Aeq,T}$ dB

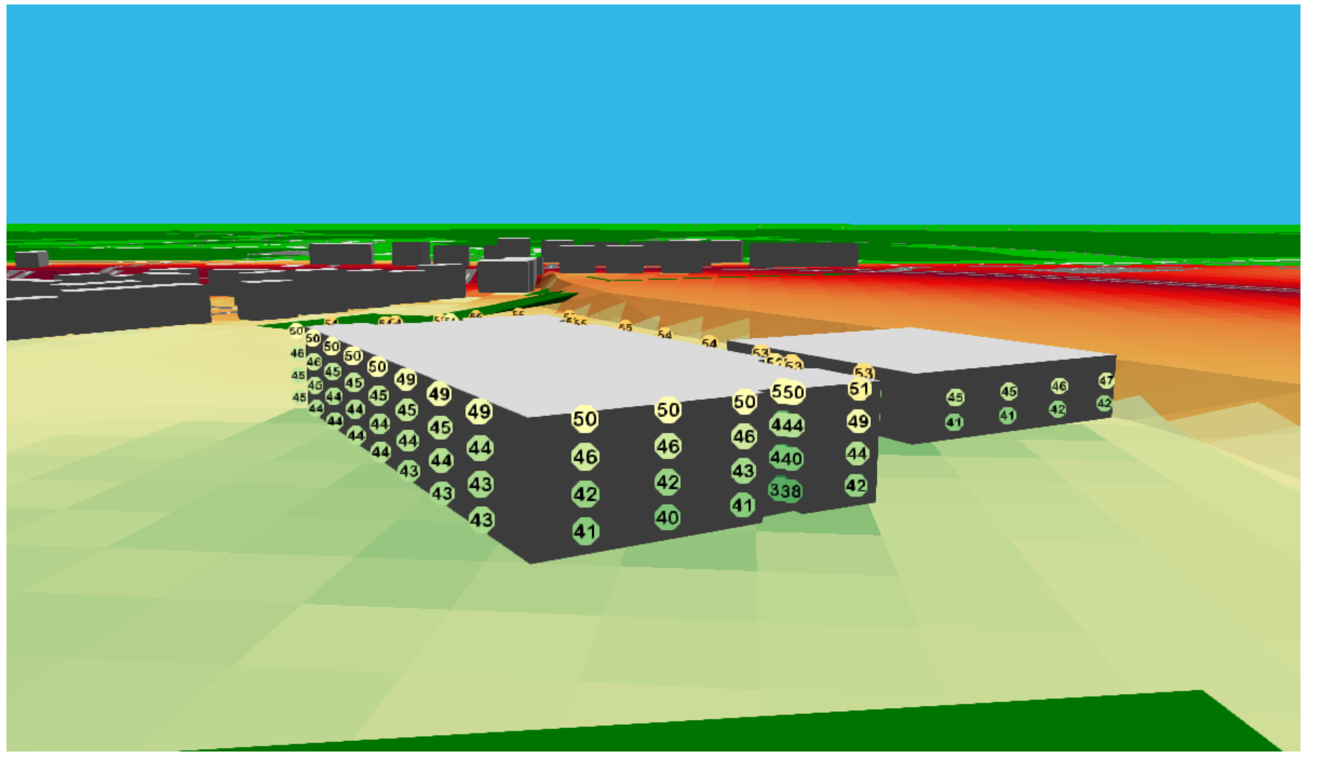


Figure 3—4 3D representation of predicted daytime façade incident ambient noise levels from the north façades, $L_{Aeq,T}$ dB

4 Façade Acoustic Design & Noise Break-In

4.1 Introduction

This section details a preliminary façade sound insulation assessment of the proposed building and the suitability of employing a natural ventilation strategy.

The acoustic design of façades depends primarily on two factors:

1. the existing levels of external noise
2. the target internal ambient noise levels for each space.

It is generally accepted that glazing and ventilation openings within external façades will be the weakest elements acoustically; therefore the design focuses on these elements.

The assessment of the feasibility of the use of natural ventilation is undertaken on the generally accepted assumption with regards to the level of sound attenuation achieved via a façade with an open window:

external level – 15 dB = internal level

BB93 gives internal noise level criteria for all teaching and student spaces, based upon the use of each space. Noise from mechanical services and noise ingress through the façade must not exceed this noise level, specified in terms of $L_{Aeq,T}$ dB and $L_{A1,T}$ dB. It does not include noise generated by the occupant and their activities.

4.2 Acceptable Internal Ambient Noise levels

Acceptable internal ambient noise levels (IANLs) within specific room types shall not exceed the values detailed in Table 4—1. The internal ambient noise level includes noise contributions from steady-state noise sources such as:

- External noise such as traffic, rail, aircraft and industrial/commercial noise
- Building services such as ventilation systems and mechanical plant.

It does not include noise generated by the occupant and their activities. It should be noted that only a small sample of noise-sensitive rooms are listed below and may be subject to change when the final room types are established.

Table 4—1 Upper internal ambient noise level limits (source BB93:2015 Table 1)

Room Type (Index)	Type of space	Upper limit for indoor ambient noise level $L_{Aeq,30min}$ dB(A)
1	Any area designed for students with special educational needs (SEN)	30
2	General classroom, small group room, lecture room, seminar room SEN calming room Music classroom Small and large practice/group room Performance/recital room Drama studio, assembly hall, multi-purpose hall (drama, PE, audio-visual presentations, assembly, occasional music)	35
3	Open-plan teaching space Library: resource area, quiet study area Study room (individual study, remedial work, teacher preparation) Science laboratory Design and technology (materials, textile, food, ICT room, art…) Sports hall, gymnasium, dance/activity studio Staff offices, medical room Meeting room, interviewing/counselling room, videoconference room	40
4	Dining room Atrium, circulation space not intended for teaching and learning Corridors, stairwells, coats	45
5	Changing area Toilets Kitchen	50

4.3 Proposed Ventilation Strategy

4.3.1 Strategy overview

It is understood that the standard classrooms will be ventilated through a VES unit (model iBreezeTM HRU800) situated behind a suspended raft. This unit provides both supply and extract ventilation, with operable windows used to provide additional ventilation during the summer months. On this basis, the system is "mixed-mode" and acoustically is indifferent to natural ventilation, as the system operates on a natural ventilation basis for at least some of the time.

It is understood that the system can operate fully mechanically where necessary (e.g. if external noise levels are too high to permit natural ventilation). Still, the optimised mode of operation is to run in the natural state where possible to reduce carbon emissions.

4.3.2 Influence on internal ambient noise level criteria

The mode of ventilation affects the internal ambient noise level targets. Based on the system described above, internal ambient noise levels must comply with the following extract from BB93 (February 2015) which states:

> *"Noise from building services under normal conditions should meet the limits for indoor ambient noise level (IANL) given in Table 1 [*Table 4—1 *presented above]. The design should show that IANLs can be achieved when the ventilation systems are operating in their normal condition, when providing intermittent boost, and when operation to control summertime overheating. The tolerances on the IANL limits in Table 1 [Table 4—1 above] for different types of ventilation system under different operating conditions are summarised in Table 2 [Table 4—2 presented below].*
>
> *Where external ambient free field noise levels at the façade expressed as the LAeq,30min, do not exceed the IANL figures given in Table 1 [Table 4—1presented above] 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. However, the ventilation strategy still requires appropriate design of façade openings, height differences between low and high level openings, corridor transfer vents/stacks, etc., to limit the required façade open areas appropriately.*
>
> *Where there is a hybrid system, any mechanical system components should meet the IANL limits from Table 1 [Table 4—1 presented above]. The total noise level including external noise ingress may exceed the IANL limit from Table 1 [Table 4—1 presented above] by up to 5 dB."*

Table 4—2 Summary of ventilation condition, system type and associated IANL tolerance (source: BB93:2015 Table 2)

Condition	Ventilation system	Noise level limit
Normal - ventilation for normal teaching and learning activities	Mechanical[1]	Table 1 value
	Natural[2]	Table 1 value + 5 dB[4]
	Hybrid[2]	Mechanical system noise: Table 1 value
		Total noise level: Table 1 value + 5 dB
Summertime[5] - ventilation under local control of teacher to prevent overheating – allowable during the hottest 200 hrs of the year	Mechanical	Table 1 value + 5 dB[4]
	Natural or Hybrid	≤55 dB
Intermittent boost[6] – ventilation under local control of teacher for dilution of fumes during practical activities as in practical spaces for science, art, food technology and design and technology	Mechanical	Table 1 value + 5 dB[4]
	Natural	≤55 dB
Process - extract[3] can be automatic ventilation for safety and/or under local control of teacher	Mechanical and/or natural	See IoA/ANC guide[Ref1] for operational noise levels

1 The normal condition for a ventilation system with a purely mechanical air supply is defined as when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,000ppm with the maximum concentration not exceeding 1,500ppm for more than 20 consecutive minutes on any day during normal School operating hours. This would normally equate to a minimum ventilation rate of approximately 8l/s per person. Mechanical ventilation in this context refers to systems (or parts of systems) that use mechanical fans to mix or drive the air including those in mechanical, hybrid, mixed-mode and natural ventilation systems and fan convector heaters.

2 The normal condition for a ventilation system in natural or hybrid 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. For hybrid systems, the mechanical noise excluding external noise break-in should meet the IANL figure in Table 4—1.

3 Process extract includes the operational noise from local exhaust ventilation systems and boost ventilation under the local control of the teacher as required for fume and dust extract in design and technology, odour and steam from cookers in food technology, fume cupboard extract and similar process extract systems.

4 The +5 dB does not apply to teaching and learning spaces where Table 4—1 IANL is greater than or equal to 45 dB.

Natural, mechanical or hybrid ventilation systems may be used to improve thermal comfort in summer at the expense of higher indoor ambient noise levels. The normal ventilation IANL can be exceeded during the hottest 200 hours in peak summertime conditions and the design should show that IANLs, defined in Table 4—1 can be met under these conditions as well as under normal operation. The ventilation must be under the local control of the teacher so that the noise level can be reduced to normal levels when needed. This does not apply to classrooms intended specifically for students with special hearing and communication needs, or to speech therapy rooms

5 Natural, mechanical or hybrid ventilation systems may be used to improve thermal comfort in summer at the expense of higher indoor ambient noise levels. The normal ventilation IANL can be exceeded during the hottest 200 hours in peak summertime conditions and the design should show that IANLs, defined in Table 4—1 can be met under these conditions as well as under normal operation. This does not apply to classrooms intended specifically for students with special hearing and communication needs, or to speech therapy rooms.

6 The noise level from locally controlled intermittent boost mechanical ventilation may exceed the IANL by up to 5 dB.

4.4 Feasibility of Natural Ventilation

When the mixed-mode ventilation systems are operating in natural ventilation mode, the IANL targets increase by 5 dB within the teaching and working spaces of the proposed development.

It is, however, advised by BB93 that specialist teaching spaces for students with special hearing and communication needs are always mechanically ventilated and that the +5 dB should not be applied to teaching and learning spaces where the IANL is greater than or equal to $L_{Aeq,30min}$ 45 dB.

Table 4—3 Analysis of natural ventilation suitability against IANL targets for the different room types shows the highest permissible façade incident noise levels for naturally ventilating the different room types described in Table 4—1

The noise levels incident to the façades have been calculated to reach a maximum level of $L_{Aeq,30min}$ 53 dB (shown Figure 3—2). It is understood that a specialist teaching area requiring IANL's of $L_{Aeq,T} \leq 45$ dB is situated at the northern facade within this development (Room type 1 in Table 4—3). On this basis (and based on the most recent plans provided by the architect), these areas will require mechanical ventilation:

- SEN RB room on the first floor (Figure 4—2)

The rest of the development has been calculated to be subject to incident noise levels at or lower than the maximum permissible noise level calculated above, and natural ventilation is, therefore, suitable throughout. Figure 4—1 and Figure 4—2 illustrates this ventilation strategy.

Table 4—3 Analysis of natural ventilation suitability against IANL targets for the different room types

Room type - See Table 4—1	Maximum internal ambient noise level – $L_{Aeq,30min}$ dB	IANL tolerance for employing natural ventilation (dB)	Noise increase through a façade with an open window (inside to outside) – dB	Maximum noise level limits incident to the façade permitting natural ventilation $L_{Aeq,30min}$ – dB
1	30	+0	+15	≤ 45
2	35	+5		≤ 55
3	40	+5		≤ 60
4	45	+0		≤ 60
5	50	+0		≤ 65

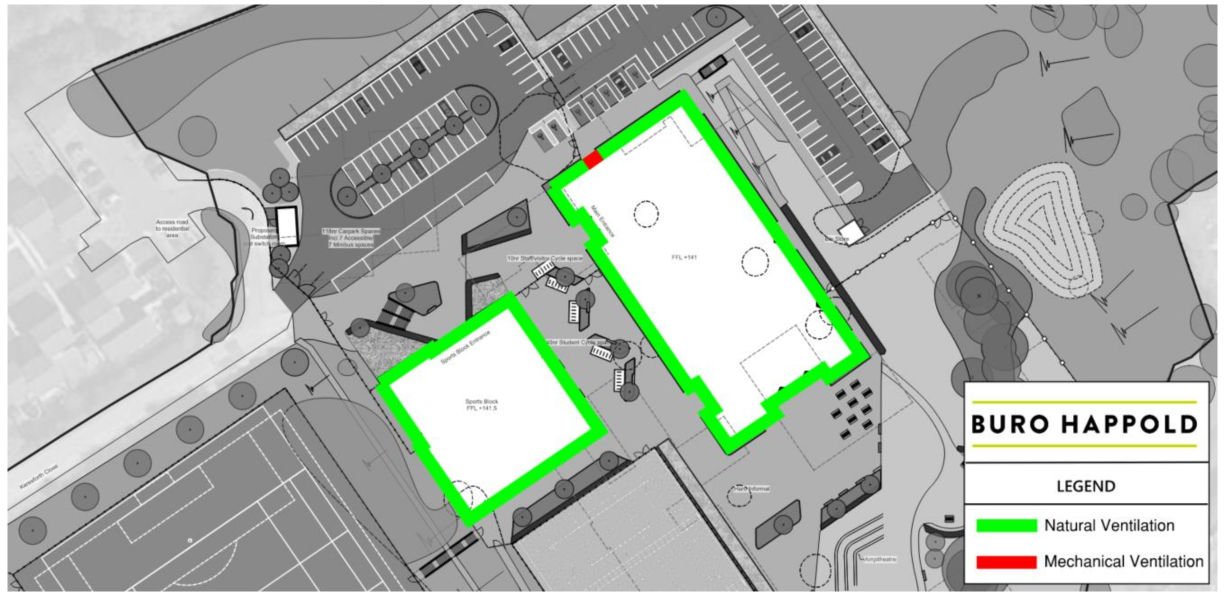


Figure 4—1 Level 01 Proposed ventilation strategy for the Astley Cooper school development

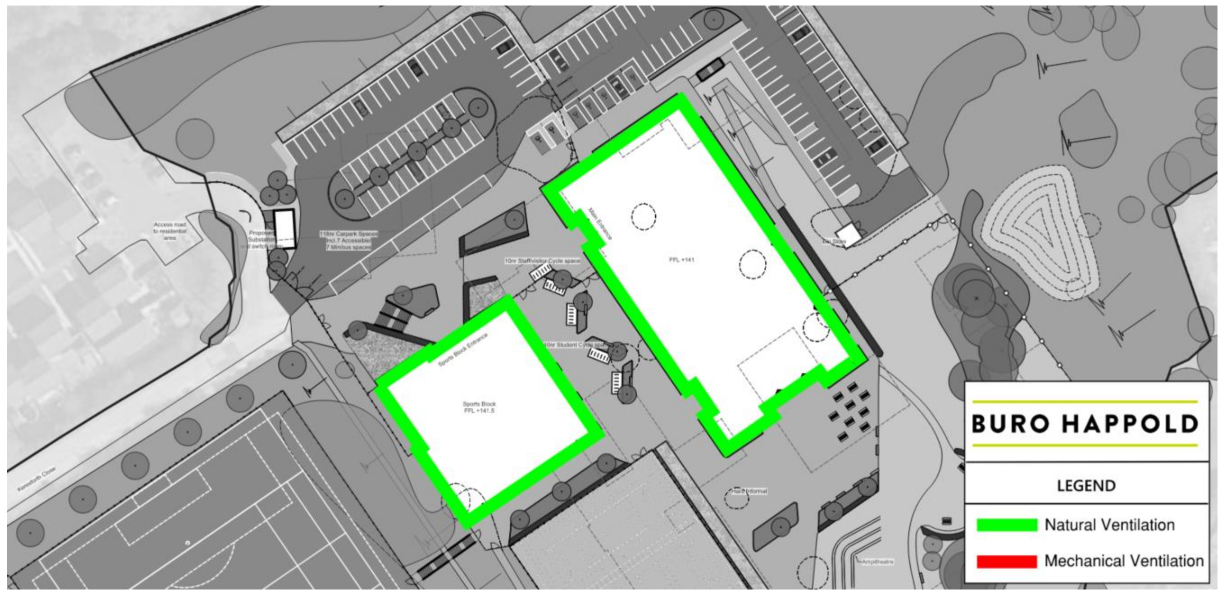


Figure 4—2 Level 00 and 02 Proposed ventilation strategy for the Astley Cooper school development

4.4.1 Ventilation strategy during summertime

Natural, mechanical or hybrid ventilation systems may be used to improve thermal comfort in summer at the expense of higher indoor ambient noise levels. The normal ventilation IANL can be exceeded during the hottest 200 hours in peak summertime conditions, and the design should show that IANL criteria, defined in Figure 4—2, can be met under these conditions as well as under normal operation. It should be noted that ventilation must be under the local control of the teacher so that the noise level can be reduced to normal levels when needed.

This does not apply to classrooms intended specifically for students with special hearing and communication needs, or to speech therapy rooms, to which more stringent controls apply. For reference, summertime IANL criteria are reproduced in Table 4—4.

Based on a 15 dB attenuation through an open window, the highest accepted external noise level to adopt a natural or hybrid ventilation strategy is $L_{Aeq,T}$ 70 dB.

Façade noise levels of up to $L_{Aeq,T}$ 53 dB, have been predicted at the most exposed elevation of the proposed development, which is within tolerance. Therefore, it will be possible to open windows for 200 hours a year, maintaining compliance with BB93:2015.

4.4.2 Heat recovery unit attenuation

In reference to Section 3, the maximum predicted external façade levels on the **western and southern** facades of the main school block is up to $L_{Aeq,T}$ 53 dB and on the **northern** façade is $L_{Aeq,T}$ 53 dB.

The weighted sound reduction through the VES unit is understood to be approximately $R_w + C_{tr}$ 23 dB. For spaces that can be naturally ventilated, the attenuation of the VES unit is expected to be significantly greater than the path through an open window, and the ingress via the unit itself should be immaterial, and no additional attenuation would be required.

For spaces that are exposed to noise levels that do not allow natural ventilation, the following table shows a measured external noise level spectrum at the most exposed façade, the approximate insertion loss of the VES system and the resulting predicted IANL from external noise.

As can be seen, the internal ambient noise level is compliant for all room types, and therefore no additional attenuation is required.

Table 4—4 Proposed ventilation strategy overview

Condition	Ventilation system	Internal Ambient Noise level limit
Summertime – ventilation under the local control of teacher to prevent overheating – allowable during the hottest 200 hours of the year	Mechanical	Table 4—1 value + 5 dB*
	Natural or Hybrid	≤ 55 dB(A)
* The +5 dB does not apply to teaching and learning spaces where the IANL is greater than or equal to 45 dB(A).		

Table 4—5 Required insertion loss for room side attenuators at western and southern facades - Room type 2)

	Octave band centre frequency						
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	dB(A)
Highest external noise level at facade $L_{eq,T}$	55	51	49	49	45	40	53
Approx. insertion loss (VES iBreeze^{TM} HRU800) system)	10	21	29	40	40	41	e-
The resultant internal ambient level (without attenuation)	45	30	20	9	5	-1	30
Attenuation required	**n/a**	**m/a**	**n/a**	**n/a**	**n/a**	**n/a**	-
Resulting internal ambient noise level	n/a	n/a	n/a	n/a	n/a	n/a	-

Table 4—6 Required insertion loss for room side attenuators at northern façade - Room type 1)

	Octave band centre frequency						
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	dB(A)
Highest external noise level at facade $L_{eq,T}$	52	48	46	46	42	37	50
Approx. insertion loss (VES iBreeze^{TM} HRU800) system)	10	21	29	40	40	41	-
The resultant internal ambient level (without attenuation)	42	27	17	6	2	-4	27
Attenuation required	**n/a**	**m/a**	**n/a**	**n/a**	**n/a**	**n/a**	-
Resulting internal ambient noise level	n/a	n/a	n/a	n/a	n/a	n/a	-

4.5 Façade Glazing Requirement

The glass rating $R_w + C_{tr}$ is generally used to define attenuation against road traffic noise, based upon typical road traffic spectra. The façade acoustic requirements are given in terms of $R_w + C_{tr}$ which is defined as:

- **Weighted Sound Reduction Index, R_w** - is a single figure value that describes the standardised performance of partitions when measured in a laboratory
- **Correction Traffic, C_{tr}** – The correction to a sound insulation quantity such as R_w. The correction targets low frequency sound sources such as traffic and music noise.

If the windows are open for ventilation, the performance of the glass is immaterial, as any sound will simply travel through the opening. Any glazing that meets thermal performance requirements will also meet the (low) acoustic requirements in areas that are suitable for natural ventilation. However, for elevations where the noise levels are too high to permit natural ventilation and so the windows will be closed, the performance of the glazing system is important.

$$R_w + C_{tr} = \textit{External dB(A)} - \textit{Internal dB(A)}$$

The highest ambient noise level on each of the façades is calculated to be as follows:

- $L_{Aeq,30\ min}$ 50 dB on the northern façade
- $L_{Aeq,30\ min}$ 53 dB on the southern façade
- $L_{Aeq,30\ min}$ 50 dB on the eastern façade
- $L_{Aeq,30\ min}$ 53 dB on the western façade

4.5.1 Methodology

The façade sound insulation requirements are calculated using the:

- Façade incident noise levels described above
- Most stringent acceptable IANL for each elevation as defined in BB93
- Architectural drawings provided by CPMG Architects, dated October 2021
- The “more rigorous calculation method” outlined in Annex G of BS 8233:2014.

The Intervention 03 room on the first floor, highlighted in orange in Table 4—3, has been assessed based on:

- Being located on an elevation exposed to the highest noise level ($L_{Aeq,T}$ 55 dB)
- The most stringent acceptable IANL on the facade ($L_{Aeq,T}$ 35 dB)
- Smallest room volume (16 m^3)
- Largest glazed area (~2.4 m^2)

The implication of this is that this worst-case room is compliant with design targets based on the glazing system specifications given in Table 4—7. All other spaces are compliant by default.

Figure 4—3 Worst-case room used for calculations per condition. Intervention 03. First floor

Table 4—7 Minimum glazing system specifications per octave band, including traffic correction

Example glazing system	Minimum sound reduction at each octave-band centre frequency							
	125	250	500	1000	2000	4000	R_w	$R_w + C_{tr}$
4 mm float glass / 20 mm air gap / 3 mm float glass	21	17	25	35	37	31	29	25

FAÇADE BREAK-IN CALCULATION		
Project Name	Trinity Academt St Edwards	BUROHAPPOLD ENGINEERING
Room or space	Intervention 03	
Date	211117	

ROOM CONSTANT & FAÇADE AREA				Room reverberation time (s)						
Façade area (incl. window)	11.2 m2	Area of the external wall	9 m2	Tmf	125Hz	250H	500H	1kHz	2kHz	4kHz
Area of the louver	0.0 m2			0.8	0.8	0.8	0.8	0.8	0.8	0.8
Area of the windows	2.4 m2									
Area of the roof/ceiling	15.2 m2	Area of exposed envelope	26 m2							
Room Depth (x)	3.8 m									
Room Width (y)	4.0 m	Room Volume	43 m3							
Ceiling height (z)	2.8 m									

DISTANCE ATTENUATION CALCULATION			
Distance correction	No	Calculated Distance Attenuation	-
Type of distance correction	Line source		
Distance from source to microphone	-		
Distance from source to receiver	-		

FREE FIELD LEVELS AT 1m FROM THE NOISE SENSITIVE FAÇADE								
LAeq		dB(A)	####	250Hz	500H	1kHz	2kHz	4kHz
	Free Field Leq in octave bands (dB)	53	55	51	49	49	45	40
	Resultant Free-Field Leq with distance attenuation (dB(A))	53	55	51	49	49	45	40
LAmax (if applicable)		dB(A)	####	250Hz	500H	1kHz	2kHz	4kHz
	Free Field Lfmax in octave bands	-	-	-	-	-	-	-
	Resultant Free-Field LAmax with distance	-	-	-	-	-	-	-

SOUND REDUCTION PROPERTIES OF BUILDING ELEMENTS										
			####	250Hz	500Hz	1kHz	2kHz	4kHz	R_w	R_w+C_{tr} (dB)
Window (R_w)	Rw+Ctr 25dB BS12354 4/20/4		21	17	25	35	37	31	29	25
Louver (Rw)	No Louver		0	0	0	0	0	0	0	0
External wall Construction (Rw)	Typical external wall construction		46	44	46	54	62	67	52	49
Roof Construction (Rw)	Typical roof construction		99	99	99	99	99	99	99	99
			####	250Hz	500Hz	1kHz	2kHz	4kHz	$D_{n,ew}$ (dB)	
Trickle Vent ($D_{n,e,w}$)	No Vent	1 Units	200	200	200	200	200	200	-	

CALCULATED INTERNAL LAeq AND LAF,max LEVELS	####	250Hz	500H	1kHz	2kHz	4kHz
Calculated LAeq in the receiver room (dB)	32	32	22	12	6	7
Calculated LAFmax in the receiver room (dB)	-	-	-	-	-	-

L_{Aeq} (125-4000Hz)	L_{Amax} (125-4000Hz)
25 dB(A)	-

Figure 4—4 Glazing calculation for a general classroom at the southeast western elevation of Trinity Academy St Edwards

5 Plant Noise Break-out

5.1 Introduction

This section outlines plant noise limits to meet the Local Planning Authority requirements. This is to see that the acoustic amenity of the surrounding area is not compromised by the operation of the new plant.

Specific plant selections have not been finalised and the most robust method in terms of controlling noise output will be to set limiting noise levels for the plant at nearby noise-sensitive receptors (NSRs).

5.2 Plant Noise limiting Criteria

5.2.1 Barnsley Metropolitan Borough Council

Welwyn Hatfield Borough Council states the following with respect to noise pollution:

Barnsley Metropolitan Borough Council Local Plan Adopted January 2019

> *Noise and vibration can be a serious cause of nuisance. Planning cannot control the noise or vibration from existing development. However it can try to make sure that new noise sensitive development such as housing and schools is not close to existing sources of noise, including industrial uses and noise created by vehicles and other forms of transport. It can also make sure that potential noise creating uses, including industrial processes or some recreational activities, are not in places where they would be likely to cause nuisance.*

The document requires noise from new developments to be assessed but does not refer to assessment methods or specific noise targets.

A review of recent planning decisions for similar plant installations indicates that each case is judged individually, and there are no "standard" noise requirements applied across the Borough. It is, therefore, appropriate to assess noise from the proposed plant using the method described in BS 4142:2014+A1:2019.

5.2.2 Fixed plant noise limits

It is understood that plant associated with the proposed development will only run during the daytime. Therefore, plant noise emission limits will be set according to the measured background levels during the daytime.

For potential plant noise emissions, the closest NSRs to the proposed School block are residences (NSR 3) located off Keresforth Close, as shown in Figure 2—1.

The limits are based on the typical background $L_{A90,15min}$ noise level measured during the day (07:00-23:00) and night (23:00 – 07:00) period. As previously discussed, the typical background noise level was obtained from Location 1 long-term measurement (see

Table 2—1). It should be noted that the modal $L_{A90,15min}$ level was adopted as the typical background level at existing NSRs.

The measured daytime typical background noise at the closest noise-sensitive receptor was $L_{A90,15min}$ 42 dB, and the night-time was $L_{A90,15min}$ 36 dB. These levels will be used to set plant noise emission limits at the closest NSRs.

Typically, the Local Planning Authority (LPA) specifies plant noise emissions limits. However, in the absence of LPA criteria, setting plant noise Rating level limits (as defined by BS 4142:2014+A-2019) at 5 dB below the typical background noise is generally considered a robust assessment. In the context of comparing the Rating level against the typical background noise level, BS 4142:2014+A-2019 states the following:

> *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.*

As such, Table 5—1 shows the broadband plant noise Rating level that should not be exceeded at 1 m from the façades of existing noise-sensitive receptors.

Compliance with these limits should see that the noise amenity at the identified NSRs is suitably protected from noise associated with the operation of the School plant.

Individual plant items may need to be designed to a lower limit such that the overall total achieves the stated criteria above. In line with BS 4142:2014+A-2019, should the proposed plant be identified as having “acoustic features” (e.g. intermittency, tonal characteristics, and impulsivity), corrections should be applied to the noise levels generated to derive a ‘Rating’ level as required above.

5.3 Discussion

Plant noise limits have been provided, and mechanical engineers should design cumulative plant noise emissions to these limits. It is expected that noise from plant items can be controlled to meet the criteria by selecting low noise plant items and mitigation measures if necessary. These could include but are not limited to atmosphere-side attenuators, duct lagging and mass barrier screens, examples of these are shown in the figures across.

Compliance with the criteria should see that existing residents are suitably protected from plant noise associated with the development.

Table 5—1 Limiting plant rating noise levels

Period	Typical background sound level $L_{A90,T}$ - dB	Limiting plant Rating level $L_{Ar,Tr}$ - dB @ 1 m from affected façade
Daytime (07:00 -23:00)	40	35
Night-time (23:00-07:00)	39	34

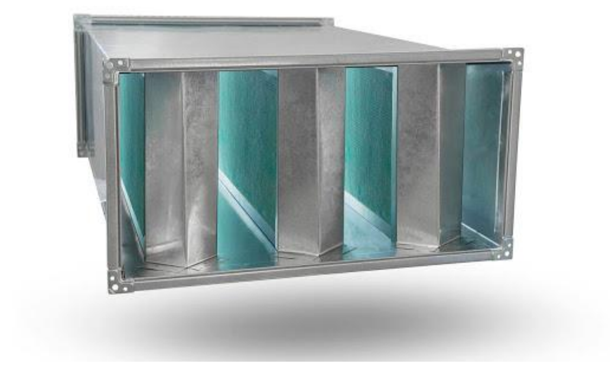


Figure 5—1 Rectangular attenuator

Figure 5—2 Circular attenuator

Figure 5—3 Duct lagging

Figure 5—4 Noise barrier with acoustic lining

6 Noise Impact of Proposed MUGA

It is understood that there will be outdoor sports areas as part of the proposed development of the Trinity Academy Development. This section details an assessment of predicted noise levels and the expected impact of using the proposed MUGA and playing fields on surrounding NSRs.

6.1 Criteria

A comparative method against the existing noise climate can be adopted in circumstances where existing noise levels are high. Traffic noise from the A6133 dominates the surrounding area; therefore, the MUGA and playing fields' noise impact may be low compared to the existing environmental noise climate.

By using this comparative method, the level of impact from a change in noise level can be assessed. The IOA/IEMA *Guidelines for Noise Impact Assessment Draft* (2007) categorises the significance of a change in noise level, whereby the thresholds applicable to different levels of impact are presented in Table 6—1.

For example, an increase in the noise level of less than 3 dB is expected to provide a 'slight impact', while increases of greater than 3 dB can have a moderate to severe impact.

6.2 Modelling

A virtual 3D acoustic model of the site and the local surrounding area was created using CadnaA version 2019 acoustic software. This exercise has been undertaken to assess the likely noise levels at the proposed NSRs as a result of noise produced by the MUGA. The model maps the predicted noise levels in the surrounding area, considering factors such as distance attenuation, screening, reflections and source directivity.

6.3 Methodology

With reference to *Artificial Grass Pitches* Acoustics Planning Implications Guide by Sport England (2015) the noise level from an outdoor sports pitch can be modelled to determine the expected noise impact. The document states that the free-field noise level from an artificial grass pitch (AGP) at a distance of ten metres from the side-line halfway marking is typically 58 dB $L_{Aeq,1hr}$.

It should be noted that the equivalent time period for this sound pressure level is one hour, which is a standard time period for a sports session. For the purpose of this assessment, each of the existing and proposed outdoor sports areas has been calibrated to this level, which is considered to be a robust method as the use of all courts has been assumed to produce an equal level of noise to a large AGP. Ground absorption has been set accordingly:

- G = 1: for the majority of the model, as there are large areas of grass and woodland
- G = 0: for courts with hard surfaces, roads and car parks

A colour contour noise map was generated to demonstrate the sound propagation across the site and neighbouring NSRs. The noise map graphically represents noise, with red colours representing loud noise levels and green colours representing quieter levels. Two noise maps were generated to assess the comparative method.

- Model 1 – represents the existing ambient noise level at the façade of the identified NSRs without the presence of the MUGA and playing fields (existing noise climate). Noise emissions are primarily due to the road traffic from the A6133
- Model 2 – Same as the above plus noise generated by the MUGA and playing fields (predicted noise climate).

Table 6—1 Categorising significance of noise change (source: IOA/IEMA, 2007)

Noise increase (dB)	Category
0	No impact
0.1 – 2.9	Slight impact
3.0 – 4.9	Moderate impact
5.0 – 9.9	Substantial impact
10.0 and more	Severe impact

Figure 6—1 Proposed MUGA and playing fields (highlighted in orange)

6.3.1 Assumption

The model has been constructed based on a worst-case scenario, whereby the proposed outdoor sports area has been modelled without a fence or acoustic barrier.

6.3.2 Limitations

The assessment has been based on the results produced through the noise modelling exercise, which provides predictions on the existing and future noise levels as a result of outdoor sports areas being used. However, an uncertainty within a range of approximately ±3 dB could typically be expected from computer noise modelling software, meaning full accuracy of predicted noise levels is not guaranteed. However, this uncertainty has been controlled as far as practicable by selecting reliable input source noise levels.

6.3.3 Results and discussion

Figure 6—2 to Figure 6—9 demonstrate that the increase in noise level with the introduction of the MUGA and playing fields is up to 2 dB. Therefore, a slight impact is expected, as shown in Table 6—1.

In terms of the subjective impact, an increase of no more than 3 dB is imperceptible under most circumstances. Therefore, the noise impact of the MUGA and playing fields is not expected to have an adverse impact upon nearby noise sensitive receivers.

Figure 6—2 Site view of proposed predicted $L_{Aeq,1hr}$ noise levels and external amenity area noise levels at NSRs

Figure 6—3 Zoomed in view of proposed predicted $L_{Aeq,1hr}$ façade noise levels and external amenity area noise levels at NSRs at north western site perimeter

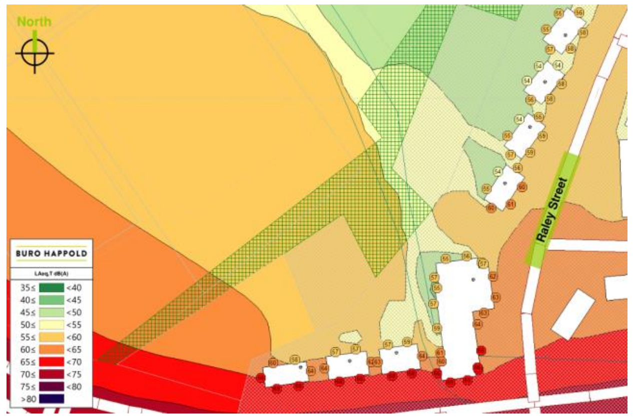


Figure 6—4 Zoomed in view of proposed predicted $L_{Aeq,1hr}$ façade noise levels and external amenity area noise levels at NSRs at the south eastern site perimeter

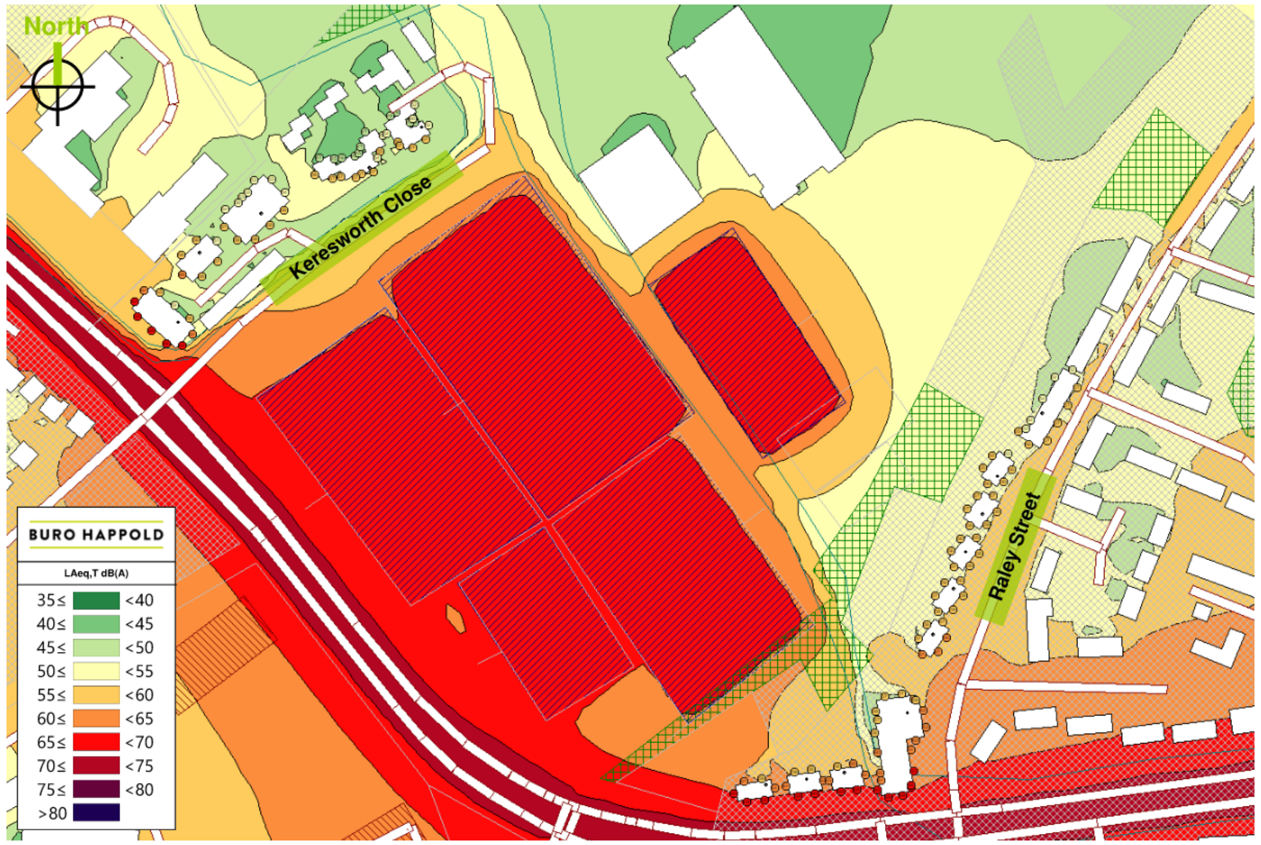


Figure 6—5 Site view of proposed predicted $L_{Aeq,1hr}$ noise levels and external amenity area noise levels at NSRs <u>with</u> predicted noise from MUGA and playing fields

Figure 6—6 Zoomed in view of proposed predicted $L_{Aeq,1hr}$ façade noise levels and external amenity area noise levels at NSRs at north western site perimeter <u>with</u> predicted noise from MUGA and playing fields

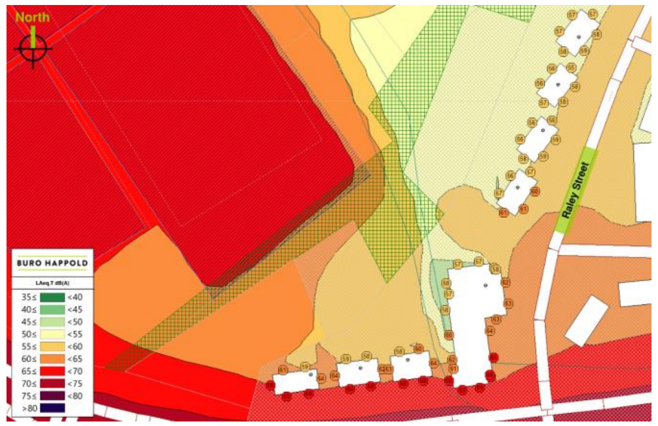


Figure 6—7 Zoomed in view of proposed predicted $L_{Aeq,1hr}$ façade noise levels and external amenity area noise levels at NSRs at the south eastern site perimeter <u>with</u> predicted noise from MUGA and playing fields

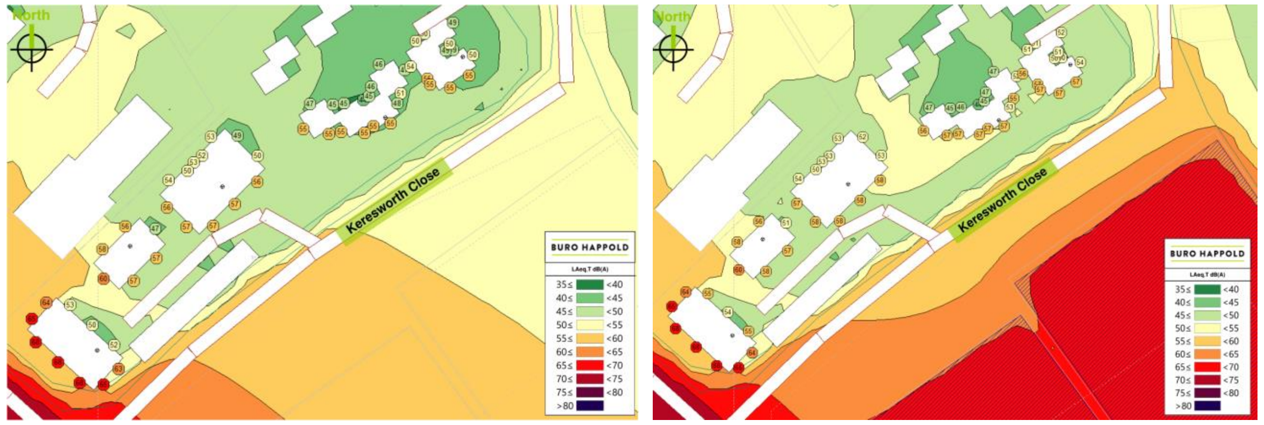


Figure 6—8 Comparing zoomed in view of proposed predicted $L_{Aeq,1hr}$ façade noise levels and external amenity area noise levels at NSRs at north western site perimeter

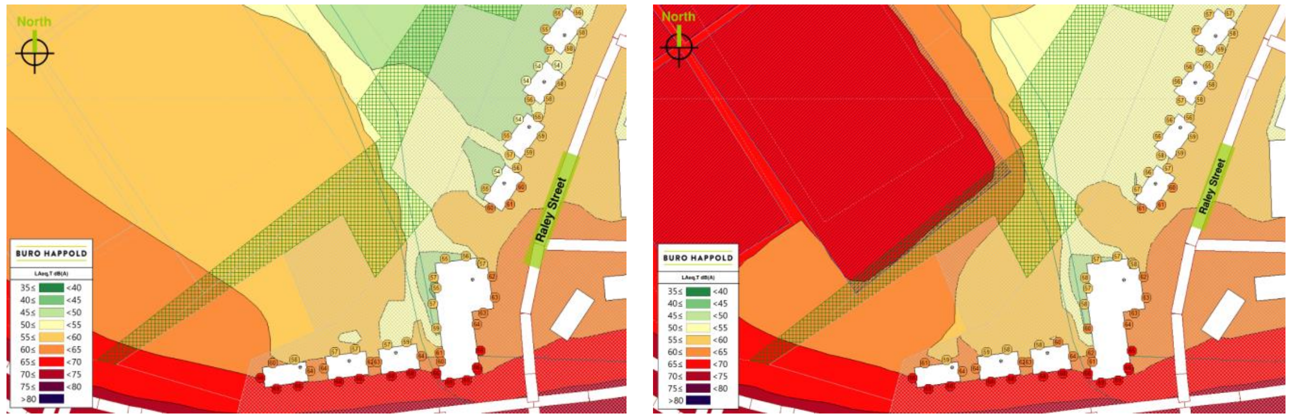


Figure 6—9 Comparing zoomed in view of proposed predicted $L_{Aeq,1hr}$ façade noise levels and external amenity area noise levels at NSRs at south eastern site perimeter

7 Conclusion

Design criteria for the proposed development have been set, based on relevant standards and guidance documents (particularly BB93), to control the impact of noise on the School itself and at nearby NSRs.

A noise assessment was carried out by Waterman to assess the noise impact of the noise environment upon the proposed School. A noise survey was not carried out due to Covid-19 and the national lockdown resulting in atypical noise levels. Therefore, an assessment using the Defra noise maps was conducted and supplemented by noise surveys for an adjacent development in 2019.

Façade noise levels have been calculated using the noise mapping software CadnaA (Version 2019). In line with the requirements of BB93, the existing noise climate at the proposed school development is such that acceptable internal ambient noise levels can be achieved with windows open for natural ventilation on all façades except for SEN RB room on Level 01. Any glazing that meets thermal performance requirements will also meet the (low) acoustic requirements on all façades.

The highest noise level calculated to impact the façades of the buildings is $L_{Aeq,T}$ 53 dB. It is, therefore, possible to open all windows for 200 hours a year, maintaining compliance with BB93 in all the spaces understood to be within the development.

Plant noise levels should be limited to a rating level ($L_{Ar,Tr}$ dB) that is 5 dB below background noise levels at the façade of the nearest NSRs to avoid disturbance at the nearest noise-sensitive receptors (residential dwellings). Individual plant items may need to be designed to a lower limit such that the cumulative noise level of all plant items operating simultaneously achieves the stated criteria above.

Should the plant contain acoustically distinguishable features such as intermittency, tones or impulsiveness, appropriate penalties (as defined in BS 4142: 2014) should be applied to determine the maximum acceptable sound pressure level at the façade of the NSRs.

The introduction of the MUGA and playing fields is up to 2 dB. Therefore, a slight impact is expected. However, an increase of no more than 3 dB is subjectively imperceptible under most circumstances. Therefore, the noise impact of the MUGA and playing fields is not expected to have an adverse impact upon nearby noise sensitive receivers.

Based on the above, the proposed development is considered suitable in terms of noise and planning, and acoustic concerns are not considered to represent any barrier to development.

Appendix A Trinity Academy Barnsley Noise Assessment by Waterman Infrastructure & Environment Limited

Trinity Academy, Barnsley

Noise Assessment

August 2020

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Client Name:	Landsolve/Barnsley MBC
Document Reference:	WIE1725-106-R-1-1-2
Project Number:	WIE17125

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

Issue	Date	Prepared by	Checked by	Approved by
001	August 2020	Paul Melvin Principal Consultant	Mark Maclagan Technical Director	Mark Maclagan Technical Director

Comments

Comments

Disclaimer

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Appendices

1. Introduction

Waterman Infrastructure & Environment Ltd (hereafter '*Waterman*') was appointed by Landsolve/Barnsley MBC ('the Client') to undertake a noise assessment in support of the planning application being submitted to Barnsley Metropolitan Borough Council (hereafter *'the Council'*) for a new school building and associated playing fields and outdoor space on land adjacent to Keresforth Close, Barnsley S70 (hereafter '*the Site*').

Since current road traffic flows have been reduced across the U.K. due to the current health crisis associated with Covid-19, noise emissions from local and major road networks have also decreased. As such environmental noise survey data has been referenced from a recent noise impact assessment carried out at an adjacent site prior to the March 2020 lockdown.

This report provides recommendations and mitigation measures to provide suitable amenity for the future school occupants and to protect the amenity of nearby existing residents..

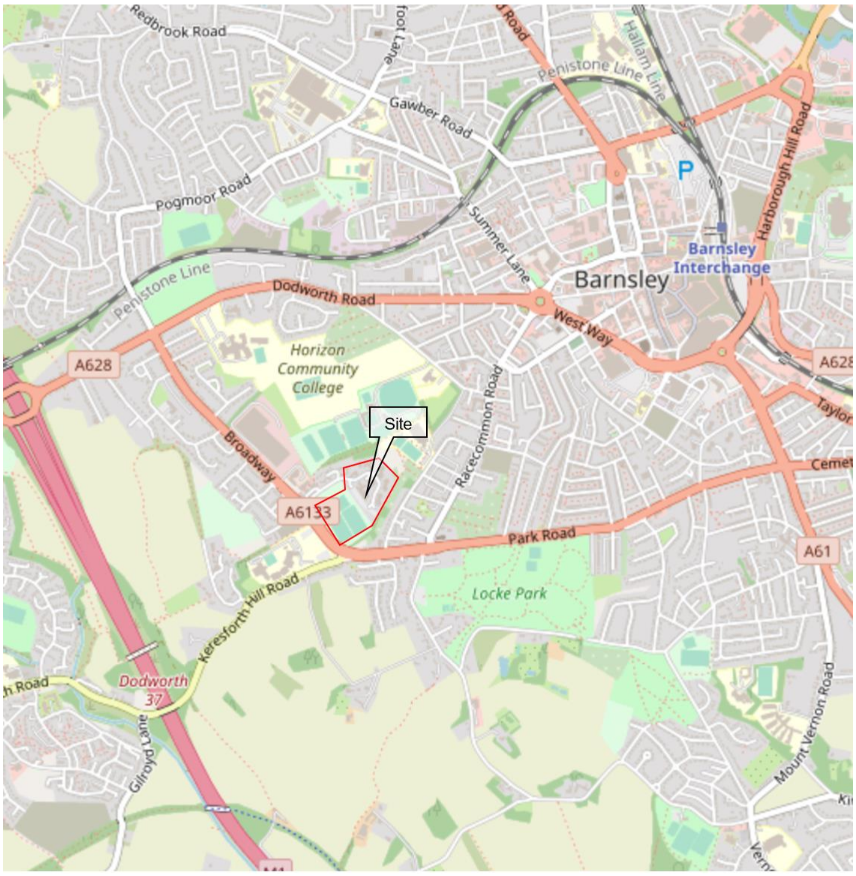
A glossary of the acoustic terminology used within this report is presented as Appendix A.

1.1 Site Context

The Site comprises c. 7.4 hectares (ha) and is located within Kingstone which forms the south-western suburban extent of Barnsley. Barnsley town centre is situated c. 1.2km north-east of the Site.

The site is bounded by Broadway to the south-west, residential properties and playing fields to the north, Joseph Locke Primary school to the east and a mixture of allotments and two-storey residential properties to the south-east. A site context plan is shown in Figure 1.

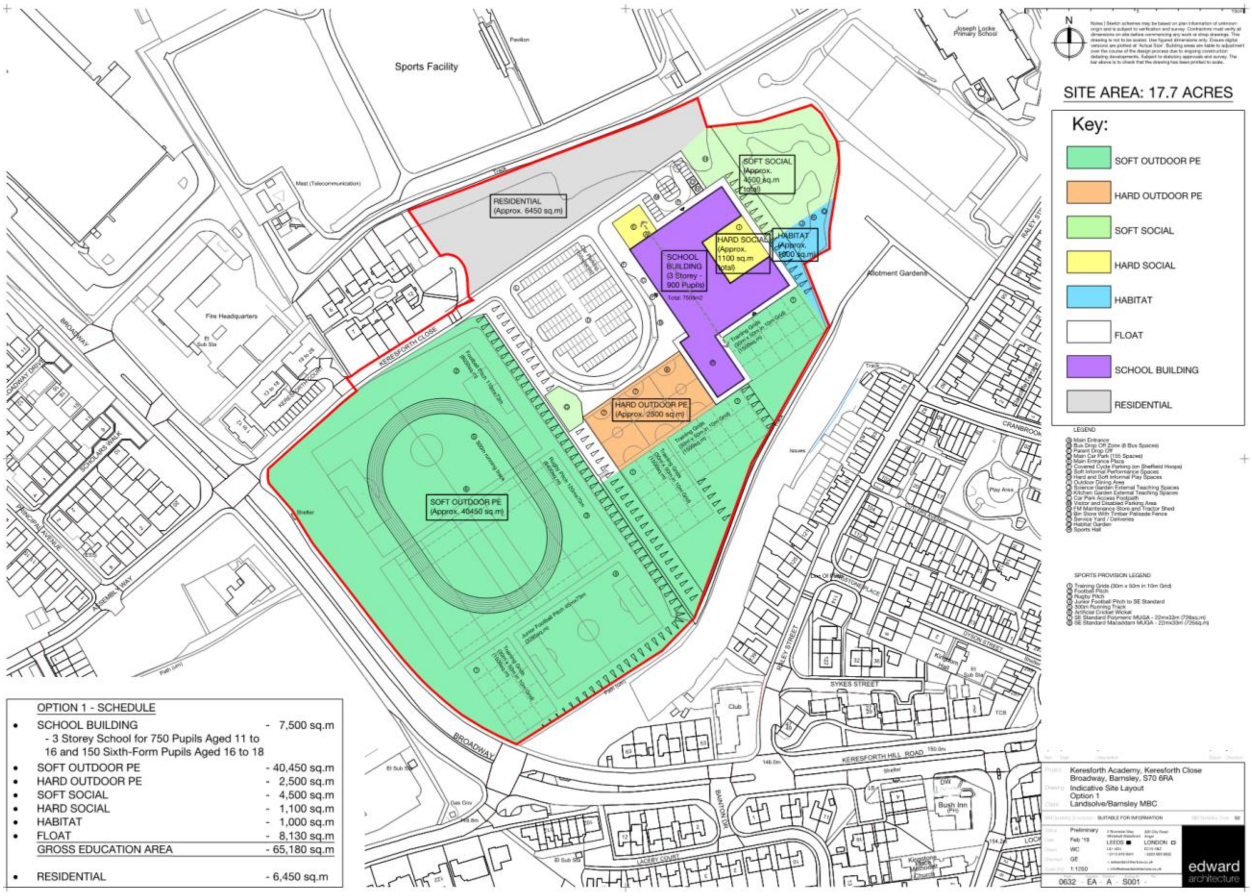
Figure 1: Site Location Plan (Source: www.openstreetmap.org)



1.2 Proposed Development

The Proposed Development consists of the demolition of all structures within the Site boundary to facilitate the construction of Trinity Academy Barnsley which is to provide a 900-place secondary school on the Site. The development will include a new school building in the north-east, hard landscaping car park in the centre of the Site and both soft and hard landscaping sports fields in the surrounding area. .

Figure 2: Indicative Site Layout Plan (Edward Architects Indicative Site Layout Option 1).



For the Academy, dedicated on site car parking will be provided consisting of 155 car parking spaces with a separated area for blue badge holders and visitors. This car parking will be principally for staff. 7 coach bays are proposed within the car park.

2. Assessment Criteria

2.1 Assessment of Residential Amenity- Noise

The most recent guidance with regard to new residential development within England is contained within ProPG "Planning and Noise New Residential Development". The primary goal of ProPG is to assist the delivery of sustainable development by promoting good health and well-being through the effective management of noise. The emphasis of the ProPG is consideration of good acoustic design, thereby creating places that are both comfortable and attractive to live in, where acoustics is considered integral to the living environment. ProPG is only applicable where industrial/commercial noise affecting a site is not dominant, with the emphasis on transportation noise, and is therefore applicable to the development Site.

The ProPG advocates a systematic proportionate, risk based, 2-stage approach.

- **Stage 1**: an initial noise risk assessment of the proposed development site; and
- **Stage 2**: a systematic consideration of four key elements:
    - Element 1 – demonstrating a "Good Acoustic Design Process";
    - Element 2 – observing internal "Noise Level Guidelines";
    - Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
    - Element 4 – consideration of "Other Relevant Issues".

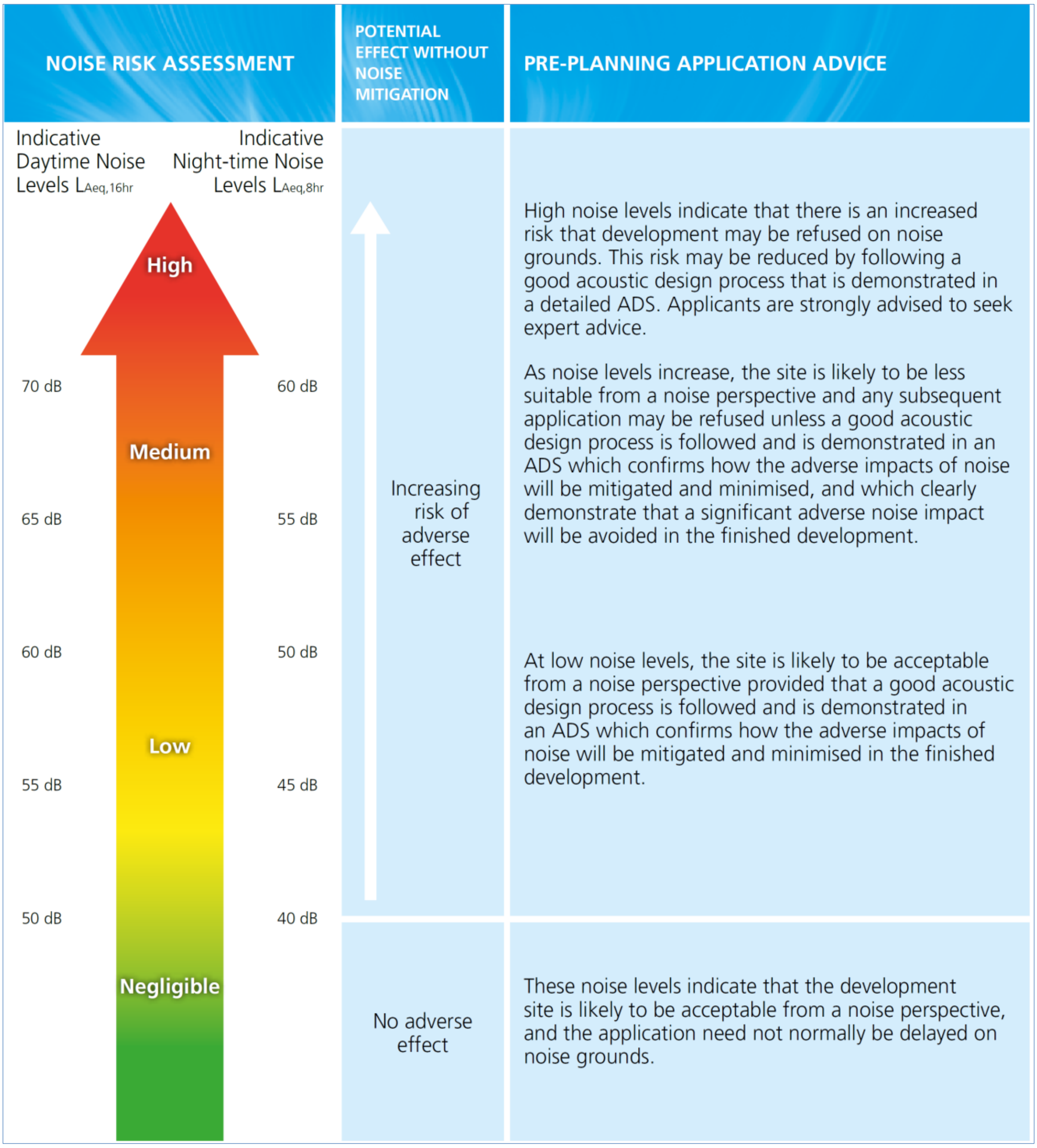
The above approach is underpinned by the preparation and delivery of an Acoustic Design Statement (ADS). The ADS for a site assessed as high risk should be more detailed than a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk.

2.1.1 Stage 1- Initial Noise Risk Assessment

The initial noise risk assessment is based on the prevailing day (07:00-23:00) and night-time (23:00-07:00) noise levels at the site, established through either measurement or prediction, without any new or additional mitigation. This provides an indication of the likely risk of adverse effects from noise were no subsequent mitigation is included as part of the development proposals. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

Figure 1 from the ProPG has been reproduced illustrating the associated noise risks based on the prevailing noise levels. It is important to note that the assessment of noise risk serves to provide an indication as to the initial suitability of the site for residential development and as to what the acoustic issues are likely to be.

Figure 3: Noise Risk Assessment Reproduced From ProPG



Note:

a).Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.

b).Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is “not dominant”.

c) $L_{Aeq,16h}$ is for daytime 0700-2300, $L_{Aeq,8hr}$ is for night-time 2300-0700.

d) An indication that there may be more than 10 noise events at night (2300-0700) with $L_{Amax,F}$>60dB means the site should not be regarded as negligible.

2.1.2 Stage 2- Consideration of Four Key Elements

Element 1- Good Acoustic Design

It is imperative acoustic design is considered at an early stage of the development control process. It is not just compliance with recommended internal and external noise exposure standards but is a multi-faceted and integrated approach to achieve optimal acoustic conditions. This may include strategic design layouts with set-backs, maximisation of screening effects, inclusion of soundscapes (e.g. water features for masking transport noise within communal external amenity areas).

Element 2- Internal Noise Level Guidelines

Guidance is drawn from BS8233[1]:2014 'Guidance on sound insulation and noise reduction for buildings' and is reproduced within **Table 1**. The blue text is additional ProPG guidance.

Table 1: BS8233:2014 Internal Noise Level Guideline Values

Activity	Location	Noise Level	
		Daytime	Night-time
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedrooms	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$ 45 dB $L_{Amax,F}$ (note 4)

Note 1: The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

Note 2: The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, eg 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels in the Table.

Note 3: These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to excluded occasional events, such as fireworks night or New Year's Eve.

Note 4: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AmaxF}, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.

Note 5: Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the 'open' position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

Note 6: Attention is drawn to the requirements of the Building Regulations.

Note 7: Where development is considered necessary or desirable, despite external noise levels above WHO guideline, the internal L_{Aeq} target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.

Element 3- External Amenity Area Noise Assessment

The ProPG guidance on external amenity area noise assessment reflects and extends the advice contained

[1] BSI (2014) BS8233 Guidance on sound insulation and noise reduction for buildings. BSI.

within BS8233:2014 and the current Government guidance in PPF-Noise.

3(i) "if external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended."

3(ii) "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50-55dB $L_{Aeq,16h.}$"

3(iii) "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces."

3(iv) Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process."

3(v) Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:

- a relatively quiet façade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or
- a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different protected, location); and/or
- a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.

Element 4- Assessment of Other Relevant Issues

This element seeks to build upon relevant national and local planning and noise policies to provide a systematic list of recommendations for the issues that should be considered before making a judgement about the noise aspects of a particular planning proposal for new residential development.

4(i) compliance with relevant national and local policy

4(ii) magnitude and extent of compliance with ProPG

4(iii) likely occupants of the development

4(iv) acoustic design v unintended adverse consequences

4(v) acoustic design v wider planning objectives

Not all of the issues listed above will arise in every planning application. Some will be inherent to the good acoustic design.

2.2 Acoustic Criteria for Schools

2.2.1 Internal Ambient Noise Levels

To provide school buildings with an acoustic environment that is conducive to both teaching and learning, recommended upper limits for internal ambient noise levels (IANLs) are provided within BB93. The objective of these limits is to provide suitable IANLs for:

- clear communication of speech between teacher and student, and between students; and
- for study/work activities requiring concentration.

The limits include the noise contribution from both external sources such as road traffic noise, and from internal sources such as building services plant. If a room is to be naturally ventilated, the windows are assumed to be open for calculation purposes.

Limits relevant to this assessment have been reproduced as **Table 2** below.

Table 2: BB93 Requirements for Internal Ambient Noise Levels

Room	Upper Limit IANL (dB $L_{Aeq,30mins}$) for New Build Developments
Teaching space intended specifically for students with special hearing and communication needs	30
Classrooms	35
Study rooms; Interviewing / counselling rooms; Medical rooms; Resource areas; Science laboratories; D&T and Art rooms; Indoor sports hall; Dance studio; Gym; Offices, Staff rooms	40

Additionally, in order to protect students from regular discrete noise events, e.g., aircraft or trains, indoor ambient noise levels should not exceed 60 dB $L_{A01,30mins}$. This is achieved by default for spaces with IANLs up to 40 dB $L_{Aeq,30min}$, but requires assessment in spaces with higher IANL limits, e.g., 45 and 50 dB

To determine the suitability of the Site for school development, the measured external noise levels will be assessed against the most stringent IANL criteria which for teaching spaces which in this case is 35dB $L_{Aeq,T}$. It should be noted that where natural ventilation is permitted and provided the classrooms are not for SEN use a relaxation of the internal noise levels of 5dB is permitted.

2.2.2 External Noise Levels

While the current version of BB93 does not provide ambient noise level limits for external school areas, in the absence of criteria the previous version of BB93 states that unoccupied playgrounds, playing fields, and other outdoor areas should not normally exceed 55dB $L_{Aeq,30min}$. The previous version also states that there should be at least one outdoor teaching area where noise levels are below 50dB $L_{Aeq,30min}$. If this is not possible then acoustic screening should be used to reduce the noise levels as much as practicable.

2.3 Fixed External Plant & Building Services

The primary source of guidance in determining the significance of sound of an industrial and/or commercial nature on residential receptors, is provided in BS 4142:2014 +A1:2019 – 'Methods for Rating and Assessing Industrial and Commercial Sound'[2].

[2] British Standards Institution. British Standard 2019, BS 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*'. BSI

BS 4142 states that the potential impact from fixed external plant is based on the noise level difference between the source, known as the 'specific sound' level ($L_{Aeq,T}$), compared with the 'background sound' level ($L_{A90,T}$) that exists in the absence of the source in question. Where the sound contains any acoustic characteristics such as tonality, impulsiveness and intermittency then the specific sound level is adjusted in-line with BS 4142 advice to determine the rating level ($L_{Ar,Tr}$).

Typically, the greater the difference between the rating level and the background sound level the greater the potential of an adverse impact. BS 4142 states:-

- A difference of + 10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of +5dB or more is likely to be an indication of an adverse impact, depending on the context.
- 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.

At this stage in the design of the development, specific details of the type, number and configuration of building services plant are not known. Consequently, it is not possible to undertake a quantitative noise assessment at this time. In light of this, noise limits have been recommended based on the results of the baseline noise survey and guidance provided in BS4142, having regard to the requirements of LBC.

3. Baseline Conditions

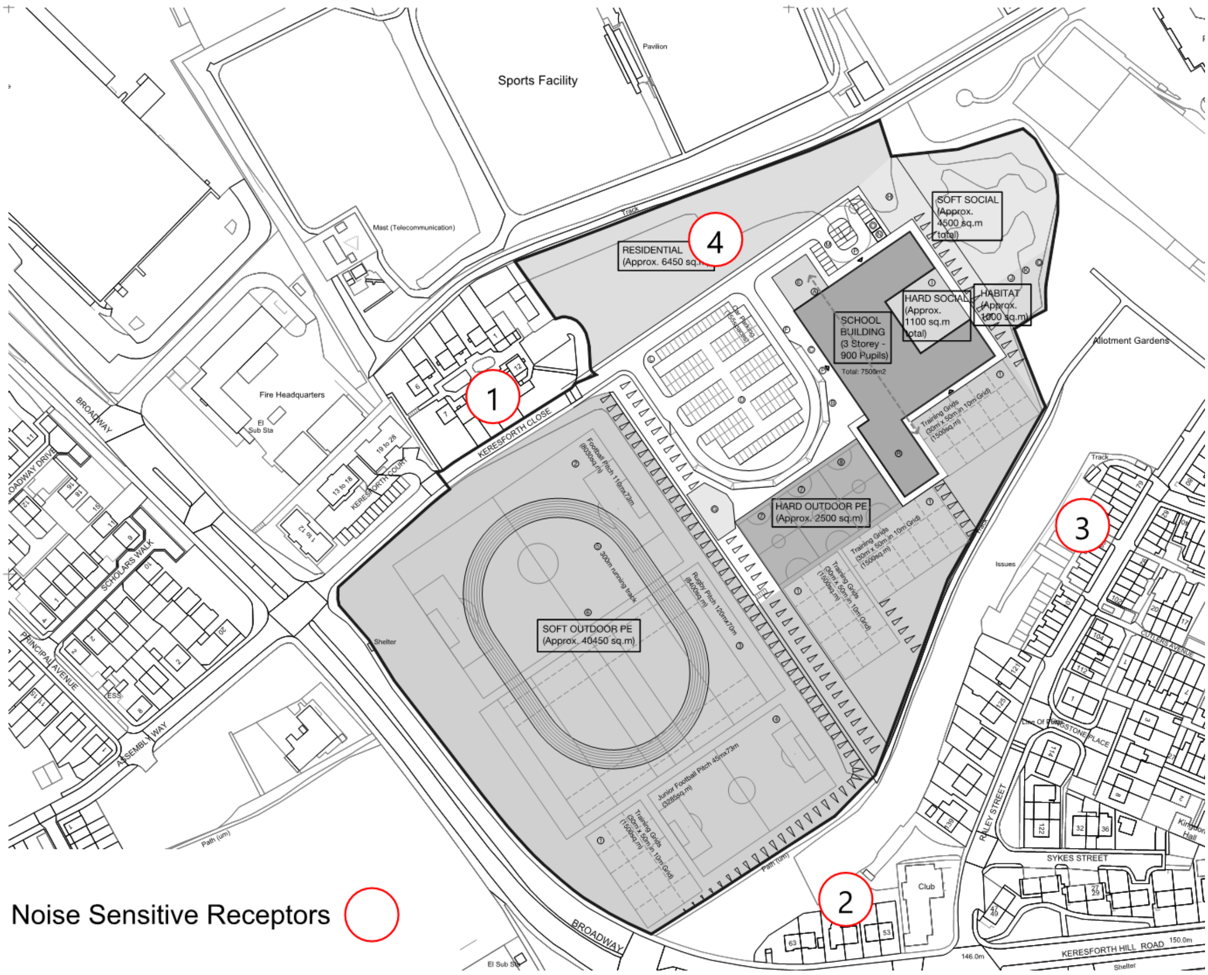
3.1 Sensitive Receptors

The nearest sensitive receptors (SR) to the Site boundary were identified, they are described in Table 3 and presented as Figure 4.

Table 3: Potential Sensitive Receptors

SR (Figure 4)	Description	Approximate Distance from Site Boundary (m)
1	Residential properties	50m
2	Residential properties	75m
3	Residential properties	75m
4	Future residential properties	50m

Figure 4: Location of Noise Sensitive Receptors (Edward Architects Indicative Site Layout Option 1).



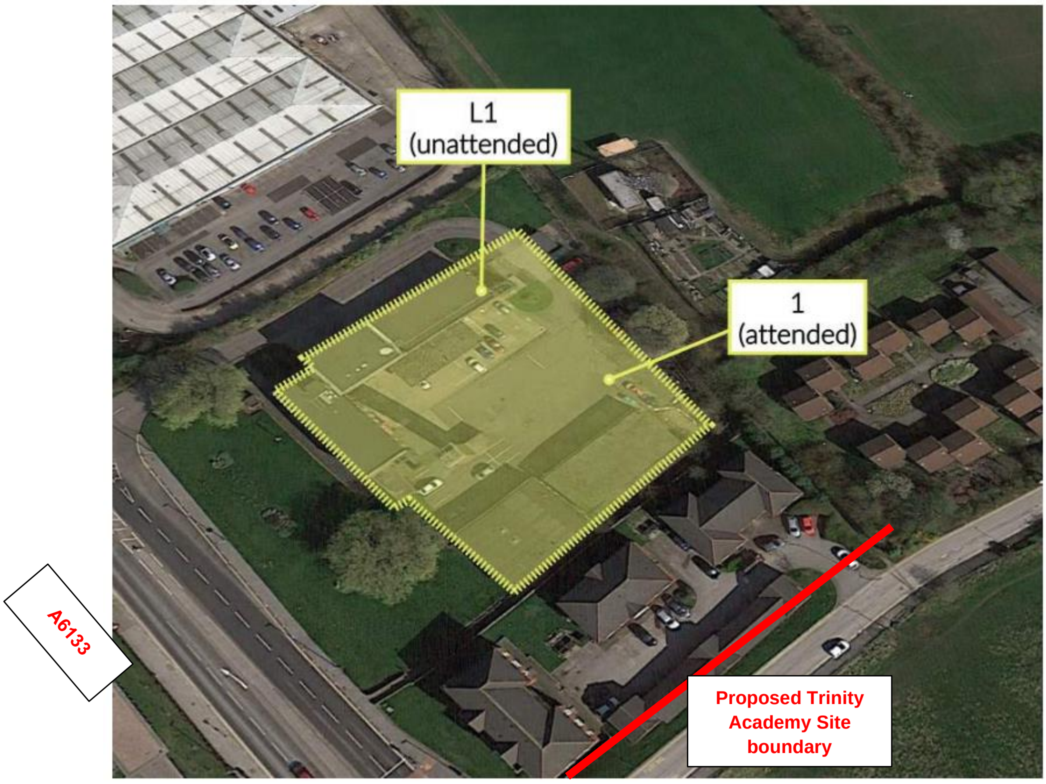
3.2 Baseline Noise Monitoring

Reduced noise levels associated with reduced traffic flows due to the Covid-19 health pandemic in the U.K. means that acoustic designs based on current noise levels could potentially underperform when road traffic levels increase in the future.

It is proposed that noise data from a previous noise impact assessment adjacent to the proposed Site is used for robustness in addition to readily available noise mapping data from Extrium noise mapping view (http://extrium.co.uk/noiseviewer.html) and Site Suitability Indicator (https://ssi.noiseconsultants.co.uk/) both presented in Section 3.3 below.

A noise impact assessment of Barnsley Fire Station located at 56 Broadway, Barnsley S70 6QZ approximately 100m to the north of the proposed Site was carried out by Hoare Lea and submitted in December 2019 (*Report 20191134 REP-1011589-05-AM-20190904-Noise Impact Assessment-Rev2 rec 20 1 20*). As detailed in the report, a noise survey was undertaken was between Thursday 8th and Saturday 10th August 2019 and included a mix of unattended ('Position 1') and attended ('Position 2') noise measurements recording noise parameters $L_{Aeq,5min}$, $L_{Amax,5min}$, $L_{A10,5min}$ and $L_{A90,,5min}$ under dry and 'no wind' conditions. It should be noted that only Position 1 noise data will be used for this report as Position 2 noise measurements are understood to have been specific attended measurements of drills at the existing fire station. Position 1 was located on the roof of the fire station approximately 80m from the A6133 motorway. The Barnsley Fire Station noise survey locations are presented in Figure 5.

Figure 5: Barnsley Fire Station Noise Survey in View of Proposed Trinity Academy Site Boundary and the A6133.



The report states that sound level meters were calibrated before and on completion with no significant drift detected.

The following text in italics has been reproduced from the Hoare Lea report.

<u>Position L1: Rooftop level towards the north of the site</u>

The following table shows the average measured ambient sound levels (L_{Aeq}), the measured background sound levels (L_{A90}) and the measured maximum sound levels (L_{Amax}) during the survey:

Table 4 Results of Hoare Lea Noise Survey

Period	$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A90,T}$
Thursday (11:00 - 23:00)	*54.9*	*63 - 82*	*40.3*
Thursday night	*47.9*	*57 - 85*	*36.0*
Friday	*52.9*	*62 - 82*	*43.2*
Friday night (23:00 – 03:00)	*44.8*	*57 - 61*	*35.6*

The daytime average noise level was $L_{Aeq,16hr}$ 53.8dB. The night-time average noise level was $L_{Aeq,8hr}$ 47.1dB.

Maximum noise levels for the night-time measurement period were reasonably consistent at L_{Amax} 55-73dB with only two peaks over the 2-day period higher than this, attributed to emergency vehicle sirens.

The typical lowest measured background level during the day was $L_{A90(1\text{-}hour)}$ 40dB, measured in the late evening on each day of the monitoring survey.

The typical lowest measured background level during times when use of the drill yard is most likely to occur (10:30 to 13:00 and 19:00 to 21:00) was $L_{A90(1\text{-}hour)}$ 44dB.

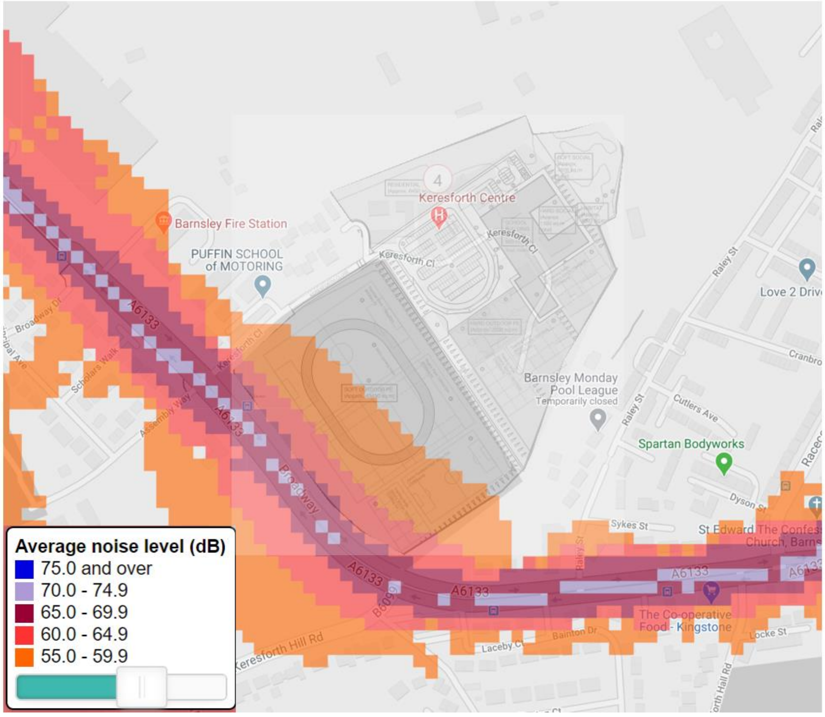
The lowest typical measured background level during the night was $L_{A90(15\text{-}min)}$ 39dB, measured between 00:00 and 02:00 on each night of the monitoring survey.

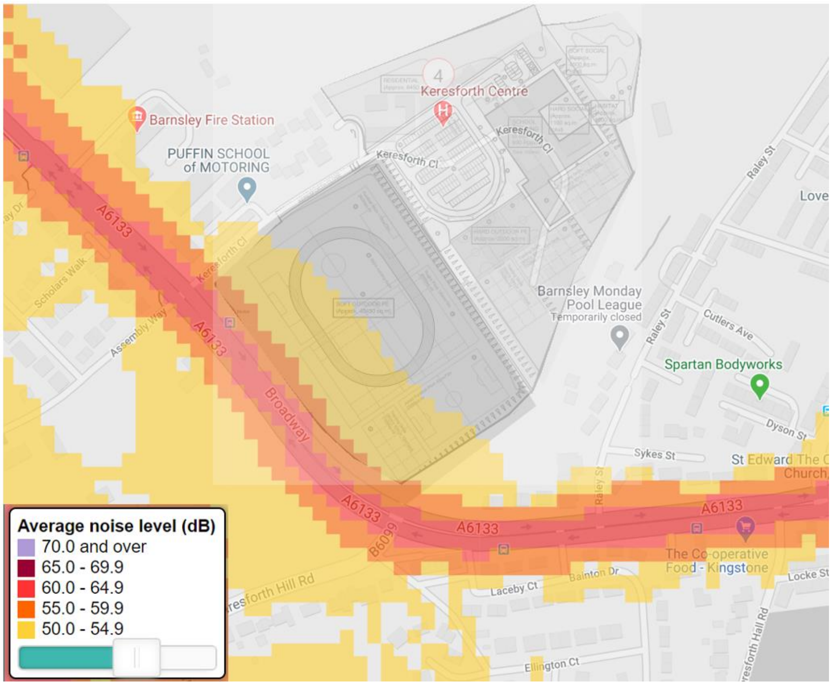
3.3 Environmental Noise Mapping Levels

3.3.1 Extrium Noise Viewer

The following images present the daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ road traffic noise levels as obtained via Extrium Noise Viewer. The Indicative Site Layout Option 1 drawing has been overlaid approximately. The strategic noise maps are based on the most recently published versions (2017) by Defra and are based on a 10m grid at a receptor height of 4m above ground.

Figure 6: Extrium Day $L_{Aeq,16hr}$ (top) and Night $L_{Aeq,8hr}$ (bottom) Road Traffic Noise Levels.

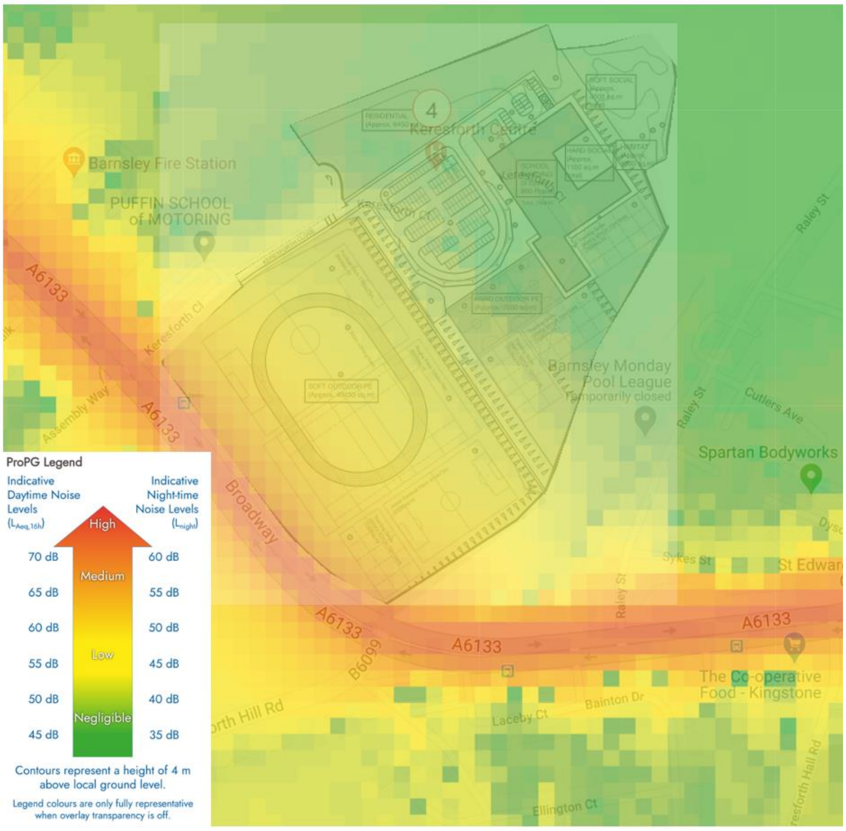


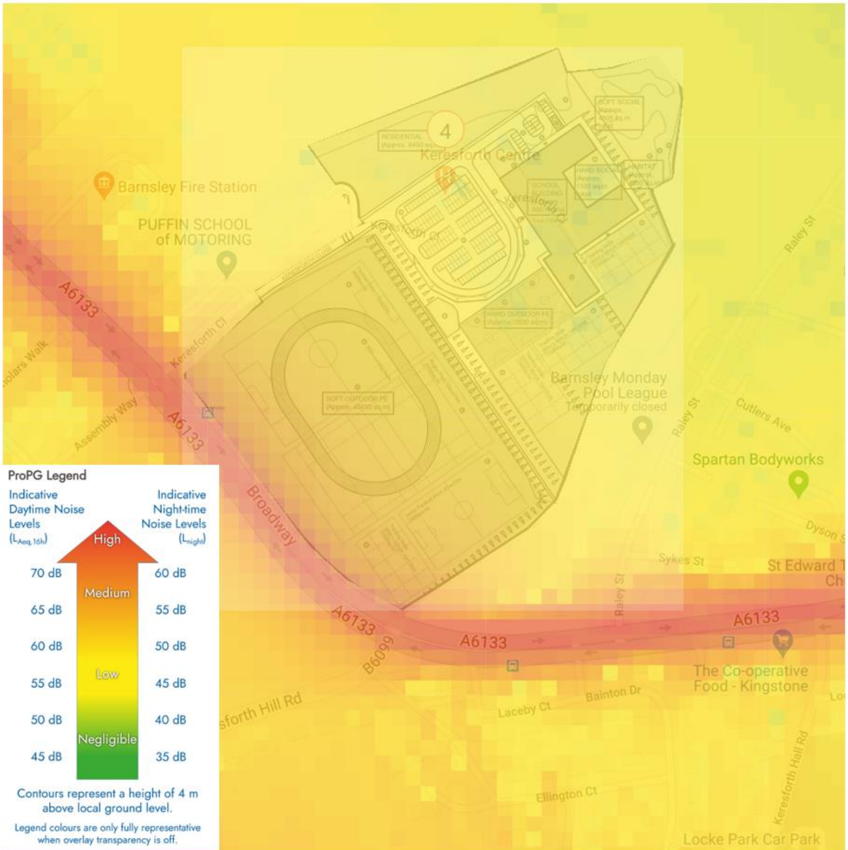


3.3.2 Site Suitability Indicator

The Site Suitability Indicator (SSI) has been developed with the aim of informing the decision-making process of noise practitioners, developers and Local Planning Authorities considering the suitability of a site in England for new residential development from a noise perspective. The following images present the daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ road traffic noise levels and is also based on a 10m grid at a receptor height of 4m above ground. The Indicative Site Layout Option 1 is also approximately overlaid.

Figure 7: Site Suitability Indicator Day $L_{Aeq,16hr}$ (top) and Night $L_{Aeq,8hr}$ (bottom) Road Traffic Noise Levels.





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4. Noise Assessment

4.1 Residential Initial Site Noise Risk Assessment

Figure 6 and Figure 7 indicate that during the daytime period (0700-2300), the prevailing noise risk is negligible with ambient noise levels being ≤50dB $L_{Aeq,16h}$. During the night-time period (2300-0700), the prevailing noise risk is predominantly a low risk with noise levels <55dB $L_{Aeq,8\ hour}$.

In light of the above during both the daytime and night-time period standard double glazed units providing circa 25dB R_{w+ctr} would be adequate to ensure that adequate internal and external noise levels are achieved. Given that during the night-time low risk has been predicted acoustic trickle ventilators may be required for the noisiest facades.

Further assessment of the residential element of the development would be completed if this element of the development is brought forward and once detailed designs are available.

4.2 School Assessment

4.2.1 Internal Noise Levels

With reference to Figure 6 and Figure 7 it can be seen that all facades of the school building would be exposed to noise levels which are less that 50dB $L_{Aeq,T,30\ mins.}$ Guidance provided in BB93 states that where openable windows are provided a façade performance of circa 15dB can be expected. Based upon the above noise levels within classrooms would be expected to be circa 35dB $L_{Aeq,30\ mins}$. Such noise levels are in line with the requirements of BB93 and as such no additional mitigation is likely to be required.

Notwithstanding the above it is advised that once traffic flows return to “normal” post covid further surveys are completed to inform the final design of the development.

4.2.2 External Noise Levels

During the daytime period when the school would be operational noise levels would range from 60dB $L_{Aeq,30\ minute}$ proximate to the Broadway reducing to <50dB $L_{Aeq,30\ minute}$ adjacent to the school building. As such, although areas of the playing fields located to the south of the site would be exposed to noise levels of greater than 55dB $L_{Aeq,\ 30\ minute}$ the majority of the playing fields and outdoor teaching areas would be exposed to noise levels which are in line with the requirements of BB93.

5. External Plant & Building Services Noise Limits

At this stage of the design process, the specific type, configuration or location of fixed plant and building services are not defined and therefore appropriate plant noise emission limits have been recommended.

Based upon BS4142 guidance, it is recommended that noise emissions from fixed mechanical plant and building services be limited to 5dB below background at the nearest identified noise receptors. Table 5 presents recommended plant noise limits for existing residential receptors adjacent to the proposed Site.

Table 5: Recommended Plant Noise Limits for Existing Receptors

Sensitive Receptors	Period	Measured Background Noise Level dB L_{A90}[1]	Plant Noise Limit dB $L_{Ar,Tr}$[2]
1	Day	40	35
	Night	39	34
2	Day	40	35
	Night	39	34
3	Day	40	35
	Night	39	34
4	Day	40	35
	Night	39	34

Note: [1] Based on modal measured background noise level. [2] Rating noise level as defined in BS4142:2014.

With regard to future residential properties within the development, it is recommended that plant noise levels do not exceed 40dB $L_{Ar,Tr}$ at 1m from the façade of the nearest property. This would result in an IANL of 25-30dB L_{Aeq}, thereby satisfying the BS8233 night-time criteria with windows open.

Plant specification would be sufficiently flexible to ensure that suitably quiet, non-tonal plant can be procured and / or mitigation options such as screening (e.g. acoustic louvres) could be installed as necessary to ensure that the plant noise criteria is met.

6. Conclusions & Recommendations

An assessment of the suitability of the site for school use has been completed. The assessment indicates that the proposed school would be exposed to noise levels of circa 50dB $L_{Aeq,30\ minutes}$. Where noise levels of this magnitude are experienced installation of standard thermal double glazed windows and ventilation via openable windows would be acceptable. As such, it is considered that the proposed site is suitable for school use.

APPENDICES

A. Acoustic Glossary

Ambient sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
A-weighting	A frequency weighting applied to measured or predicted sounds levels in order to compensate for the non-linearity of human hearing.
Background noise	Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).
Broadband	Containing the full range of frequencies.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed to mimic the operation of the human ear. The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound that is heard. The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping. Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels. The following are examples of the decibel readings of every day sounds: Four engine jet aircraft at 100m — 120 dB Riveting of steel plate at 10m — 105 dB Pneumatic drill at 10m — 90 dB Circular wood saw at 10m — 80 dB Heavy road traffic at 10m — 75 dB Telephone bell at 10m — 65 dB Male speech, average at 10m — 50 dB Whisper at 10m — 25 dB Threshold of hearing, 1000 Hz — 0 dB
dB(A): **A-weighted decibels**	The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the 'A' filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Façade Noise Level	A noise level measured or predicted at the façade of a building, typically at a distance of 1m, containing a contribution made up of reflections from the façade itself (+3 dB).
L_{Amax} noise level	This is the maximum noise level recorded over the measurement period.
L_{Amin} noise level	This is the lowest level during the measurement period.
$L_{Aeq,T}$ noise level	This is the 'equivalent continuous A-weighted sound pressure level, in decibels' and is defined in British Standard 7445 as the 'value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time'. It is a unit commonly used to describe construction noise, noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise.

L_{A90} noise level	This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.
L_{A10} noise level	This is the noise level which is achieved for 10% of the monitoring period and is often used to describe road traffic noise.
Sound Reduction Index (R)	The sound reduction index is a single-number rating of the sound reduction through a wall or other building element. Since the sound reduction may be different at different frequencies, test measurements are subjected to a standard procedure which yields a single number that is about equal to the average sound reduction in the middle of the human hearing range.
Weighted Sound Reduction Index (R_W)	Single number rating used to describe the **laboratory** airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
C_{TR}	An adjustment to the Rw scale to take account of the lower performance against a typical spectrum of road traffic noise dominated by low frequencies.
$D_{ne,W}$	Weighted element normalised level difference.
VDV	This is the vibration dose value, a measure of vibration exposure; the fourth root of the integral, over the measurement period, of the fourth power of the frequency-weighted and time-varying acceleration.

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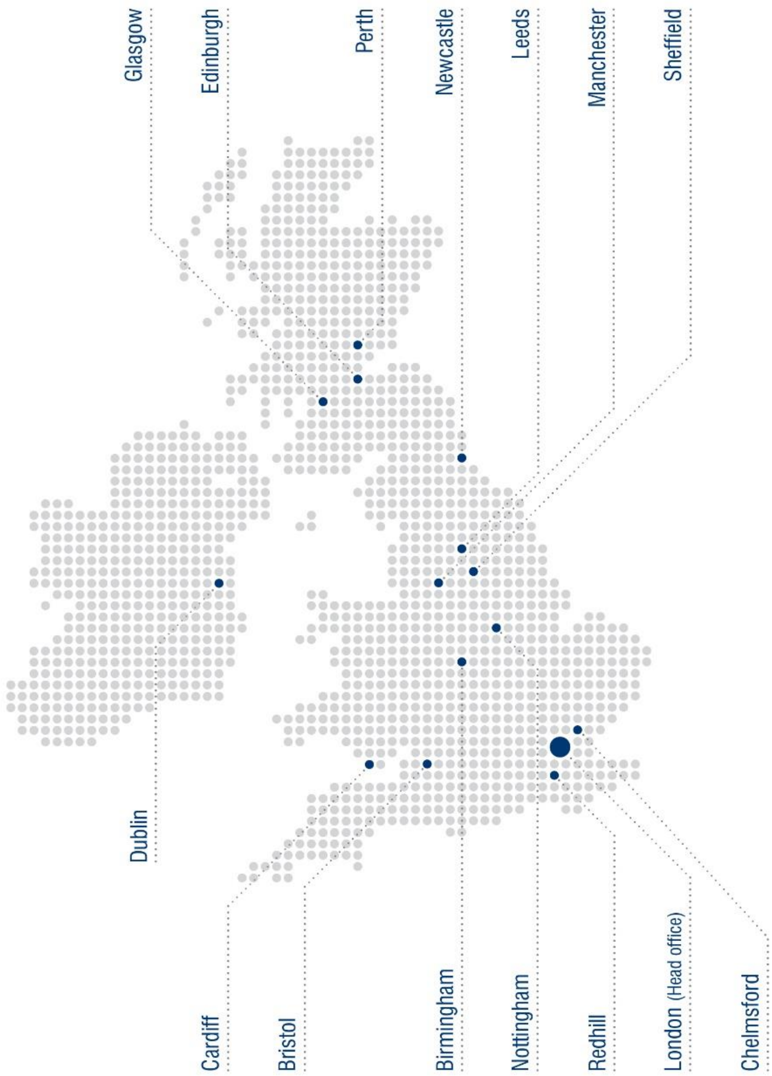
UK and Ireland Office Locations



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