



Croft Lane, Unsworth

Noise Impact Assessment

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REVISION HISTORY

Revision	Date	Revision Details	Author	Checked
R01	18/11/2021	Original Issue	Matt Jones MEng AMIOA	Susan Witterick BSc MIOA
R01A	16/05/2023	Updated to reflect design progression. Added note on ventilation tolerance re BB93	<i>Susan Witterick</i> Susan Witterick BSc MIOA	

1 INTRODUCTION

- 1.1 A new, three storey nursery is proposed to be built on land adjacent to 129 Croft Lane, Unsworth, BL9 8QH.
- 1.2 dBx Acoustics Ltd has been appointed by Mr Ashley Mihell to undertake a noise survey and noise impact assessment for the proposed nursery. The relevant Local Authority is Bury Council.
- 1.3 A glossary of acoustic terminology is presented in Appendix A.

2 BASIS OF NOISE ASSESSMENT

- 2.1 This report considers the Site's suitability for the nature of proposed uses through assessment of existing noise levels affecting the site, which have been used to carry out the following works:
 - To determine prevailing environmental noise levels affecting the site of the proposed nursery due to nearby noise sources (e.g. road traffic);
 - Assessment of potential noise intrusion to nursery spaces and development of preliminary sound reduction requirements for the building façades with consideration of the proposed ventilation strategy;
 - The setting of appropriate noise emission limits for new fixed building services plant associated with the development.
- 2.2 The noise impact assessment is based on the following:
 - Department for Education (2015) 'BB93 Acoustic Design of Schools' (BB93)
 - BS4142:2014 'Methods for Rating and Assessing Commercial Sound'

Local Authority Requirements

- 2.3 The Site lies within the jurisdiction of Bury Council.
- 2.4 Bury Council has published a guidance document *Policy EN7/2 – Noise Pollution*. Whilst the guidance is clear that occupants should be protected from noise, there is no published quantitative guidance on acoustic criteria for noise emissions from building services plant items.
- 2.5 It is therefore assumed that the scheme should comply with Building Bulletin 93 (BB93) and BS4142:4014 'Methods for Rating and Assessing Commercial and Industrial Sound' as detailed below.
- 2.6 dBx Acoustics has attempted to contact Bury Council to understand their requirement on plant noise emission limits, however no response has been received so far. Previous successful planning applications for schools and nurseries within Bury Council's jurisdiction has used a rating level, $L_{Ar,Tr}$, of no greater than 10dB below the existing background noise level at the nearest noise sensitive receptor. This limit has therefore been used in this report.

Building Bulletin 93

- 2.7 Whilst the proposed development is a nursery rather than a school, BB93 provides useful guidance for the acoustic design of a nursery and so the noise impact assessment will be based on the internal ambient noise level guidance outlined in BB93.
- 2.8 *Requirement E4 from Part E of Schedule 1 to The Building Regulations 2000 (as amended) states that:*
- "Each room or other space in a school building shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use."*
- 2.9 These regulations came into force in July 2003.
- 2.10 Part E of the Building Regulations includes schools within its scope, and gives the following guidance:
- "In the Secretary of State's view, the normal way of satisfying Requirement E4 will be to meet the values for sound insulation, reverberation time and internal ambient noise which are given in Section 1 of Building Bulletin 93 'The Acoustic Design of Schools', produced by DfES."*
- 2.11 The School Premises Regulations contain similar statements and apply to both new and existing school buildings.
- 2.12 Building Bulletin 93 (BB93) was updated in 2014 and is the current design standard applicable to compliance with the Building Regulations and the School Premises Regulations. This document includes design standards for internal ambient noise levels, reverberation time, and sound insulation between critical spaces.
- 2.13 Building Bulletin 93 specifies upper limits for indoor ambient noise level for room types classified in terms of intended use.
- 2.14 The objective is to provide suitable indoor ambient noise levels (a) for clear communication of speech between teacher and student (b) clear communication between students and (c) learning and study activities. The indoor ambient noise level includes noise contributions from:
- External sources outside the school premises (including, but not limited to, noise from road, rail and air traffic, industrial and commercial premises);
 - Building services (e.g. ventilation system, plant, etc); and
 - Actuator and damper noise.
- 2.15 Where rooms are mechanically ventilated, the plant should be assumed to be running at its maximum operating duty.

Table 1: BB93 Internal Ambient Noise Level Criteria

Room Type	Upper Limit for Internal Ambient Noise Level dBL _{Aeq,30 min}
Staff Work Room, Office, Meeting Room, Reception	40
Nursery Rooms	35
Corridor, hygiene room, WC, kitchen, foyer	50

2.16

- 2.17 BB93 details indoor ambient noise limit tolerances for different types of ventilation, as presented below.

Table 2 : Summary of Ventilation Condition, System Type and Associated IANL Tolerance

Condition	Ventilation System	Upper Limit for Indoor Ambient Noise Level
Normal – ventilation for normal teaching and learning activities	Mechanical	Table 1 value
	Natural	Table 1 value + 5dB ¹
	Hybrid	Mechanical system noise: Table 1 value
		Total noise level: Table 1 value + 5dB
Summertime – ventilation under local control of teacher to prevent overheating – allowable during the hottest 200 hrs of the year	Mechanical	Table 1 value + 5dB
	Natural or Hybrid	≤ 55dB
Intermittent boost – ventilation under local control of teachers for dilution of fumes during practical activities as in practical spaces, food technology and design technology ²	Mechanical	Table 1 value + 5dB
	Natural	≤ 55dB

- 2.18 Additionally, in order to protect students from regular discrete noise events, ambient noise levels should not exceed 60dBL_{A1,30mins}.
- 2.19 The indoor ambient noise level excludes noise contributions from teaching activities within the school premises, including noise from staff, students and equipment within the building or in the playground. Noise transmitted from adjacent spaces is addressed by the airborne and impact sound insulation requirements, which will be determined as the building design progresses.

¹ Where spaces are naturally ventilated, the IANL can be relaxed by 5 dB, provided the following conditions are met:

- The daily average carbon dioxide concentration is limited to no more than 1,000 ppm with the maximum concentration not exceeding 1,500 ppm for more than 20 consecutive minutes on any day during normal school operating hours.
- The IANL for the space before relaxation is no more than 45 dB

² Spaces with intermittent boost or ventilation under the local control of the teacher, can have a temporary increase in IANL to no more than 55 dB.

BS 4142:2014 – Methods for Rating and Assessing Industrial and Commercial Sound

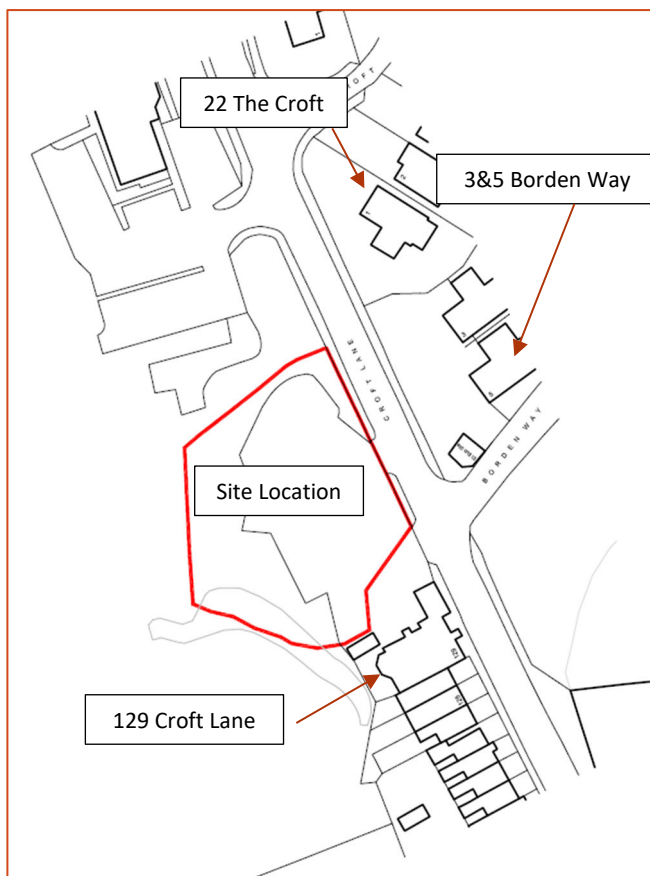
- 2.20 BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating is determined and compared with the existing local Background Sound Level.
- 2.21 The Rating Level ($dB_{L_{Ar,Tr}}$) is evaluated from the Specific Noise Level by including several, cumulative corrections to account for factors such as distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristics.
- 2.22 BS 4142:2014 seeks to determine a “representative” Background Sound Level, stating that *“...the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”*.
- 2.23 The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:
- a) Typically, the greater this difference, the greater the magnitude of the impact.
 - b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3 SITE DESCRIPTION

Site Description

- 3.1 The proposed site is on land that is currently not in use adjacent to 129 Croft Lane, Unsworth, BL9 8QH. To the northwest of the site is the River Roch and open, community use fields.
- 3.2 The site is adjacent to Croft Lane which is a busy urban road. There is housing on the far side of Croft Lane.
- 3.3 129 Croft Lane is adjacent to the site to the south. This is a shop with residential apartments above.
- 3.4 The nearest noise sensitive receptor is therefore identified as the residential apartments at 129 Croft Lane, approximately 20m to the south of the site boundary.
- 3.5 Figure 1 below illustrates the location of the site boundary and the nearby noise sensitive receptors.

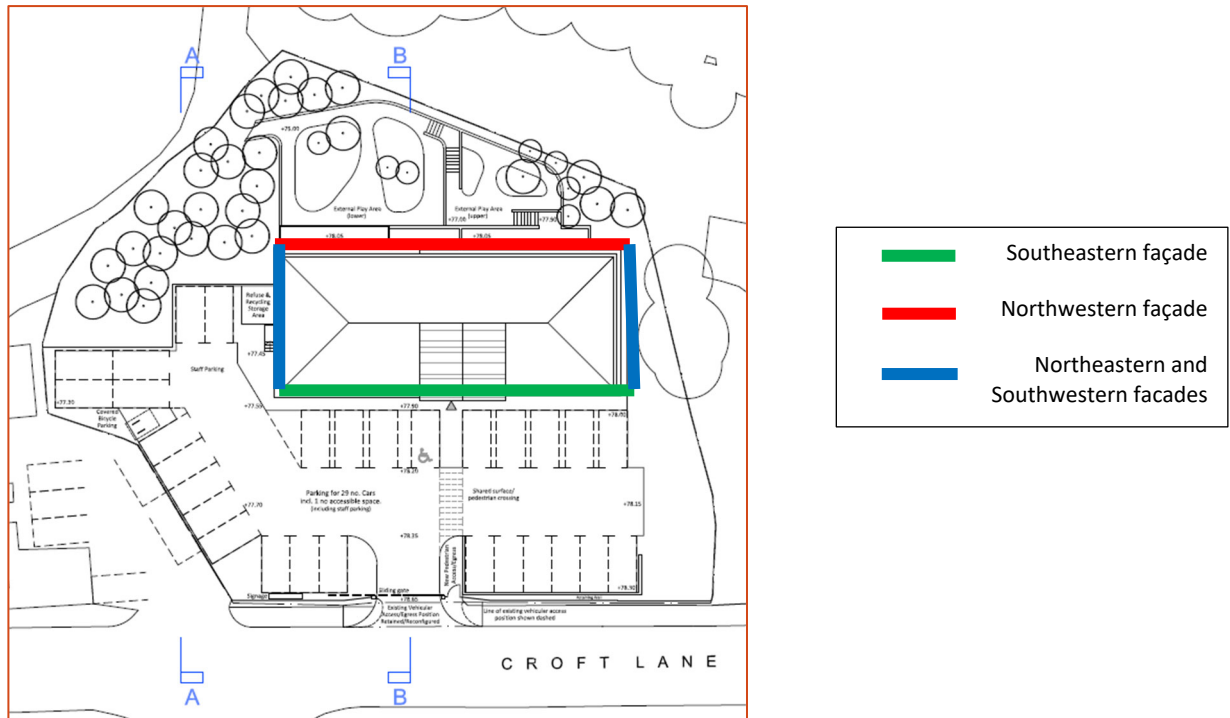
Figure 1: Site Boundary and Nearby Noise Sensitive Properties



Proposed Development

- 3.6 The proposed development is a new three-storey nursery which will include 4 rooms for pre-school aged children.
- 3.7 In addition to these rooms, the proposed development will include a meeting room and staff area on the second floor, as well as a sensory room.
- 3.8 The proposed site location plan is shown in Figure 2, below. The façade references used in the assessment are also shown.

Figure 2: Proposed Bock Plan



4 NOISE SURVEY

Methodology

- 4.1 dBx Acoustics has undertaken noise measurements at the site to establish the existing ambient, background and maximum noise levels affecting the site and its surroundings. Figure 2 below indicates the approximate measurement locations.
- 4.2 An attended noise survey was undertaken at two locations on Wednesday 27th October 2021, indicated as Locations A and B on Figure 3, below.
- 4.3 These locations were selected as representing the portion of the site most exposed to road traffic as well as the anticipated development area. The short-term measurements were made during the morning period and are considered as being representative of existing noise levels affecting the site.
- 4.4 Location A was taken at a distance of 1m from the edge of Croft Lane, at the site's southeastern boundary. Location B was taken at a location approximately 25m from Croft Lane. Location B was screened from the road traffic noise from Croft Lane and so is representative of the noise affecting the northwestern façade of the proposed development as well as representing the noise levels impacting on the adjacent noise sensitive residential properties.
- 4.5 All measurements were undertaken in accordance with BS 7445-1:2003 *Description and Measurement of Environmental Noise*, with microphones located at approximately 1.5 metres above the local ground level and at least 3.5 metres away from reflective surfaces other than the ground which can be considered as in free field conditions.

Figure 3: Noise Monitoring Locations



Noise Sources

- 4.6 The dominant noise source affecting the site and noise sensitive receptors is road traffic noise from Croft Lane.

Weather Conditions

- 4.7 Weather conditions during the measurement period were generally cool and cloudy, with scattered clouds.
- 4.8 Wind speeds were within suitable parameters for the measurement of environmental noise (i.e. generally under 5 ms^{-1}). All microphones were protected with a windshield for the duration of the survey.

Equipment

- 4.9 The equipment used during the environmental noise survey is detailed in Table 3, below.

Table 3: Equipment Used in the Environmental Noise Survey

Equipment	Manufacturer & Part No.	Serial Number
Sound Level Meter	CR:171B	G300741
Pre-amplifier	MV:200F	9082F
Microphone	MK:224	211753D
Calibrator	Cirrus CR:515	87160

- 4.10 The sound level meter was calibrated before and after measurements, with no significant drift recorded. An accredited laboratory calibrated the equipment not more than two years prior to the measurements being made, with the exception of the calibrator, which had been calibrated not more than one year prior to the survey.

5 ENVIRONMENTAL NOISE SURVEY RESULTS

Measured Noise Levels

- 5.1 A summary of the noise levels measured at noise monitoring Locations A and B are presented in Table 4, below. All measurements were 15 minutes in duration.

Table 4: Summary of Noise Survey Results at Short-term Noise Monitoring- Position C and Position D (Figure 2)

Location (Figure 3)	Date	Start Time hh:mm	Ambient Noise Level (dBL _{Aeq,T})	Maximum Noise Level (dBL _{A1,30mins})	Background Noise Level (dBL _{A90,30mins})
A	27/10/2021	07:30	76	83	65
		08:00	75	83	59
		08:30	76	84	61
B		07:45	62	71	50
		08:15	62	70	51
		08:45	61	68	50

Note: All figures rounded to the nearest whole decibel.

- 5.2 Noise levels were noted to be dominated by road traffic from Croft Lane. It can be seen that the measurements were consistent across the survey period and can therefore be considered to be representative of the typical noise climate affecting the site.

Assessment Noise Levels

- 5.3 At both locations, the loudest measured period can be considered as the 'worst-case' half an hour period as so will be used as the basis for the assessment.
- 5.4 This means that an ambient noise level of $76\text{dBL}_{\text{Aeq},30\text{mins}}$ will be considered at Location A and $62\text{dBL}_{\text{Aeq},30\text{mins}}$ will be considered at Location B.
- 5.5 Similarly, a maximum noise level of $84\text{dBL}_{\text{A1},30\text{mins}}$ will be considered at Location A and $71\text{dBL}_{\text{A1},30\text{mins}}$ at Location B.
- 5.6 To assess the daytime background noise level at the nearest noise sensitive receptor, the quietest background noise level measured will be taken as the 'worst-case' daytime background noise level at the nearest noise sensitive receptor. This is therefore $50\text{dBL}_{\text{A90},16\text{hr}}$.
- 5.7 Location A was closer to the road than the proposed southeastern façade will be as so a line source distance correction of -7 dB has been applied to both the ambient and maximum noise levels.
- 5.8 The measurements taken at Location B were measured at a location screened from Croft Lane and so they can be considered as representative of the noise levels at the northwestern façade.
- 5.9 The noise levels at the southwestern and northeastern facades were then calculated by applying a minus 3 dB angle of view correction to the southeastern noise levels.
- 5.10 The assessment noise levels are therefore presented in Table 5, below.

Table 5: Assessment Noise Levels

Facade	Ambient Noise Level ($\text{dBL}_{\text{Aeq},T}$)	Maximum Noise Level ($\text{dBL}_{\text{A1},30\text{mins}}$)	Background Noise Level ($\text{dBL}_{\text{A90},30\text{mins}}$)
Southeastern	69	77	50
Northwestern	62	71	
Northeastern	66	74	
Southwestern	66	74	

6 BUILDING ENVELOPE SOUND INSULATION

Internal Ambient Noise Criteria

- 6.1 The relevant internal noise criteria which have been adopted for the proposed nursery development using BB93 are outlined in Table 1, above, and typically vary between 35 and 50dB_{L_{Aeq,30min}}.
- 6.2 An external noise break-in assessment has been undertaken to assess the suitability of the site for the proposed development.

Assessment of Ventilation Strategy

- 6.3 In accordance with BB93 guidance, for naturally ventilated teaching spaces, an internal noise level limit of 40dB_{L_{Aeq,30mins}} is considered appropriate for nursery rooms, when naturally ventilated. BB93 also states that where external ambient free field noise levels at the façade do not exceed the IANL figures given in Table 1 by more than 16 dB for single sided ventilated spaces and 20dB for cross ventilated or roof ventilated spaces, the criteria for natural ventilation can usually be achieved.
- 6.4 Therefore, natural ventilation is generally likely to be appropriate for nursery rooms where the external noise level does not exceed 56dB_{L_{Aeq,30min}} for nursery rooms with single sided ventilation. These limits can be increased by 4dB where cross ventilation or roof ventilation is used.
- 6.5 With reference to the assessment noise levels presented in Table 4, above, ***it can be seen that natural ventilation will not be acoustically appropriate for this scheme.***
- 6.6 The windows must therefore be generally closed and ventilation provided by alternative means, such as a trickle ventilator.
- 6.7 Based on the predicted noise levels, the acoustic performance of glazed external elements (***both windows and doors***) and ventilator performances required to achieve the internal ambient noise level limits have been calculated, as detailed in Table 5, below.

Table 6: External Glazing (both windows and doors) Sound Insulation Requirements

Room	Glazing Sound Insulation Performance ¹ (dBR _w (+C _{tr}))	Example Glazing Construction ² , mm	Ventilator Sound Insulation Performance (dBD _{n,e,w} (+C _{tr}))
All occupied rooms	36 (29)	10/TC/4	33 (33)

Notes: ¹ Sound reduction performance must be achieved by the glazing unit as a whole, including frames, seals, opening lights, glazed door elements etc, as opposed to the glass panels alone; ² TC = Thermal Cavity; PVB – Polyvinyl Butyral.

- 6.8 The glazing configuration shown in Table 6 above is a suggestion only, and alternative configurations may be acoustically suitable.
- 6.9 Windows can be openable, however, must be well sealed when closed. The frames should not downgrade the sound insulation performance of the glazing.
- 6.10 The external wall and roof must achieve a sound insulation performance at least 10 dB greater than the proposed glazing sound insulation performance. The proposed constructions are understood to be under development, and so are not assessed here.

7 BUILDING SERVICES NOISE EMISSIONS

- 7.1 Any building services required to provide ventilation to the building should be designed to avoid any adverse impact on the existing and proposed residential amenity of the surrounding housing.
- 7.2 dBx Acoustics is not aware of any specific requirements in relation to BS4142:2014 from Bury Council.
- 7.3 Previously successful planning applications for nurseries within the remit of Bury Council require that noise from building services affecting the surrounding noise sensitive receptors should be controlled to give a BS4142:2014 rating level $L_{A_{r,Tr}}$ of at least 10dB below the existing background noise level.
- 7.4 It is anticipated that the nursery will only be open during the daytime period and so only a daytime assessment is necessary.
- 7.5 The typical background noise level measured during the noise survey was 50 $dBL_{A90,15min}$.
- 7.6 Therefore, plant noise emissions must be controlled such as the rating level when assessed at the nearest noise sensitive receptor (Figure 1) is no more than 40 $dBL_{A_{r,Tr}}$.
- 7.7 The noise limits are to be met at 1m from the window of the identified NSRs (Figure1).

8 SUMMARY AND CONCLUSION

- 8.1 dBx Acoustics Ltd has been appointed by Studio KMA to undertake a noise impact assessment for the proposed nursery at Croft Lane, Unsworth, BL9 8QH.
- 8.2 A noise survey was undertaken across the site to determine noise levels affecting the proposed development.
- 8.3 Based on the measured noise levels, an outline assessment has been made of the required building envelope sound insulation in order to meet the internal noise levels set out in Building Bulletin 93 for educational use.
- 8.4 It was found that natural ventilation will not be appropriate for this development.
- 8.5 Outline sound insulation requirements for glazing, ventilator and façade elements have been provided.
- 8.6 Plant noise emission limits are set in accordance with the understood requirements of Bury Council.
- 8.7 Taking the above into account, noise should not be a limiting factor in any planning application.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is $2 \times 10^{-5} \text{ N/m}^2$. The sound pressure level existing when microphone measured pressure is $2 \times 10^{-5} \text{ N/m}^2$ is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A-weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during time, T.
$L_{Amax,T}$	The instantaneous maximum A weighted sound pressure level which occurred during time, T.
$L_{Ar,Tr}$	The equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor T often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example, a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
STI	Speech Transmission Index , Metric ranging between 0 and 1 representing the transmission quality of speech with respect to intelligibility by a speech transmission channel
R	Sound Reduction Index , the laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
R_w	Weighted Sound Reduction Index , a single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
D_w	Weighted Level Difference , the weighted level difference between a pair of rooms, stated as a single figure.
D_{nT}	Standardised Level Difference , a frequency-dependent measurement of airborne sound insulation, calculated using the following formula: $D_{nT} = L_1 - L_2 + 10 \log(T/T_0)$ 60 dB Where: L_1 is the energy-averaged sound pressure level due to the pink noise source measured in the source room using a sweep technique.

L_2 is the energy-averaged sound pressure level measured in the receiving room using a sweep technique.

T is the mean receiving room reverberation time (derived from T_{30} measured in seconds).

T_0 is the reference reverberation time (= 0.5s for dwellings).

$D_{nT,w}$	Weighted Standardised Level Difference , a single-figure value of airborne sound insulation performance, derived according to procedures in BS EN ISO 717-1, based on the D_{nT} values at different frequencies (100-3150 Hz third octave bands).
$D_{nF,w}$	Weighted, Normalised Flanking Level Difference , the normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
D_{ne}	Normalised Element Level Difference , The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
$D_{n,e,w}$	Weighted, Normalised Element Level Difference , The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	Spectrum Adaptation Term , a correction term applied to the sound insulation single-number values (R_w , D_w , and $D_{nT,w}$) in accordance with BS EN ISO 717-1. Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking or moving furniture on a floor structure.
L_{nT}	Standardised Impact Sound Pressure Level , a frequency dependent measurement of impact sound insulation, calculated using the following formula: $L_{nT} = L_1 + 10\log(T/T_0)$ dB Where: L_1 is the mean sound pressure level due to the tapping machine measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (0.5s for dwellings)
$L'_{nT,w}$	Weighted Standardised Impact Sound Pressure Level , a single-figure value (@ 500 Hz) of impact sound insulation, performance, derived according to BS EN ISO 717-2, based on the L_{nT} values at different frequencies (100Hz- 3150 Hz third octave bands).
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
NR	The Noise Rating level . This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.