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Environmental Noise Assessment

**Meadow High School, New Teaching Block
Hillingdon**

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Client:	Architect:	Acoustic Consultant:
		 ACOUSTIC CONSULTANTS LTD <i>noise and acoustic specialists since 1987</i>

Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the external noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.



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1. Introduction

Galliford Try have appointed Acoustic Consultants Limited to provide noise and acoustic advice for Meadow High School in Hillingdon.

This report addresses the environmental noise aspects of the development in relation to planning conditions relating to the consent.

This report provides an assessment of the impact of noise from various aspects of the school operation on nearby noise sensitive residential properties.

The author of this report is a Member of the Institute of Acoustics (MIOA) with a recognised acoustic qualification and over fourteen years' experience in the field.

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2. The Site

The development site is located within the grounds of Meadow High School in Hillingdon. The proposal includes for a new build two storey block to provide SEN teaching accommodation and a multi-purpose hall for secondary school use.

The proposal is for a two-storey education building with SEN provision. The scheme also includes the refurbishment of the adjacent teaching block.

The school site is bordered by Philpot's Farm Open Space to the West and Royal Lane to the East. Residential areas are to the North and South.

The development is to be located to the South of the site. The nearest noise sensitive locations are the residential properties on Clarkes Drive.

The main source of noise affecting the site is road traffic on the surrounding highway network.

3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in February 2019. Section 15 entitled 'Conserving and enhancing the natural environment addresses noise as a requirement of planning. Paragraph 170 states:

"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 states:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life⁶⁰*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

60 See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).

The NPPF does not prescribe any assessment methodology or criteria to assess the adverse effect of noise.

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long-term vision of Government noise policy. This long-term vision is supported by three noise policy aims as follows:

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

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

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:



"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits. The NPSE does, however, emphasise that in dealing with noise Local Planning Authorities are required to take a balanced approach in considering the benefits of development as against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. **National Planning Practice Guidance, Noise**

The National Planning Practice Guidance (NPPG) on noise referred to here is based on the current version (January 2015) as provided on the Planning Guidance Website. It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

It provides generic guidance on how to determine the noise impact and what factors could be a concern.

It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below:



Table 1: NPPG Noise – Perception of Effect Levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels however the NPPG identifies that where noise is audible, it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

4. Relevant Noise Guidance

4.1. Plant Noise - British Standard 4142:2014

British Standard 4142:2014 entitled 'Method for rating and assessing industrial and commercial sound' use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes. The principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'.

The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours).

Section 9 entitled 'Rating Level' states: "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location.

In Section 11 of the Standard, entitled 'Assessment of the Impacts', it states: "Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9) and consider the following.

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

The Borough of Hillingdon's Council have produced a supplementary planning document for noise which states:



"British Standard 4142:1997 gives advice on measuring and assessing the noise from machinery or plant, and is relevant if surrounding residential areas might be affected. Developments with a BS4142 assessment of marginal significance or above would not ordinarily be permitted. Consequently, the development should be controlled such that the rating level of the noise from the proposed development determined according to BS4142 is at least 5 dB below the background noise level $L_{A90,T}$. Ideally, the assessment of noise should give a positive indication that complaints are unlikely."

Reference is made to British Standard 4142:1997, this has been superseded by the 2014 version and it is considered appropriate to apply the most recent guidance.

As such, the design criteria for noise from building services plant is at least 5 decibels below the existing background sound level when determined at the noise sensitive receptors.



4.2. Building Bulletin 93 – External Noise Control

Acoustic standards in school buildings are addressed under Part E of the Building Regulations 2000. The normal way of demonstrating compliance is by achieving the design criteria are set out in Section 1 of the Department for Education and Skills' current version of 'Building Bulletin 93' entitled 'Acoustic Design of Schools: Performance Standards' published in February 2015.

Table 1 of Building Bulletin 93 gives the required upper limit for the internal ambient noise level in rooms, in terms of the 'thirty-minute equivalent A-weighted noise level', in decibels, the $L_{Aeq,30 \text{ minutes}}$ and includes contributions from both external noise and building services noise.

The Building Bulletin 93 Internal Ambient Noise Level criteria in different spaces is as follows:

Table 3: Internal Ambient Noise Level Criteria

Room Type	Upper limit for the indoor ambient noise level, $L_{Aeq,30mins}$ dB	
	New Build	Refurbishment
Dining Hall	45	50
Main Hall	35	40
Secondary School Classroom	35	40
Secondary School Group room	35	40
Design and Technology (CAD/CAM)	40	45
Art Room	40	45
Sports Hall	40	45
Science Lab	40	45
Library	40	45
Meeting Room	40	45
Office/Staff Room	40	45
Toilets	50	55

5. Existing Noise Levels

An Environmental Noise Survey was undertaken by Hann Tucker Associates on behalf of the Department for Education and included the results of an on-site noise survey.

The following extracts from the Hann Tucker report show the monitoring locations used for the noise survey.

Figure 1: Hann Tucker 24-hour noise monitoring positions.

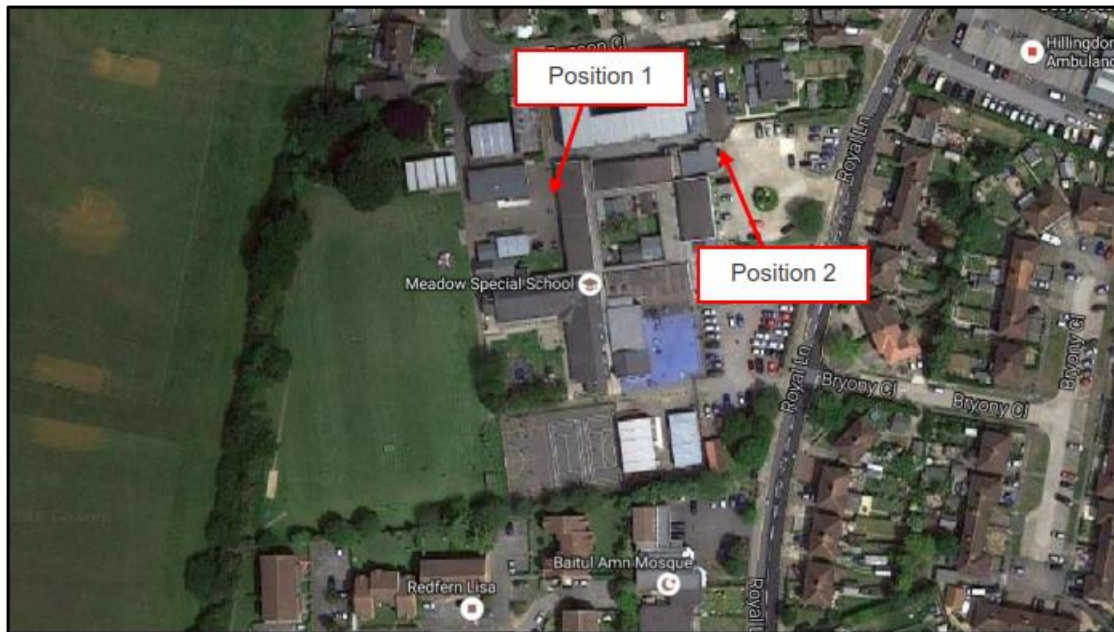
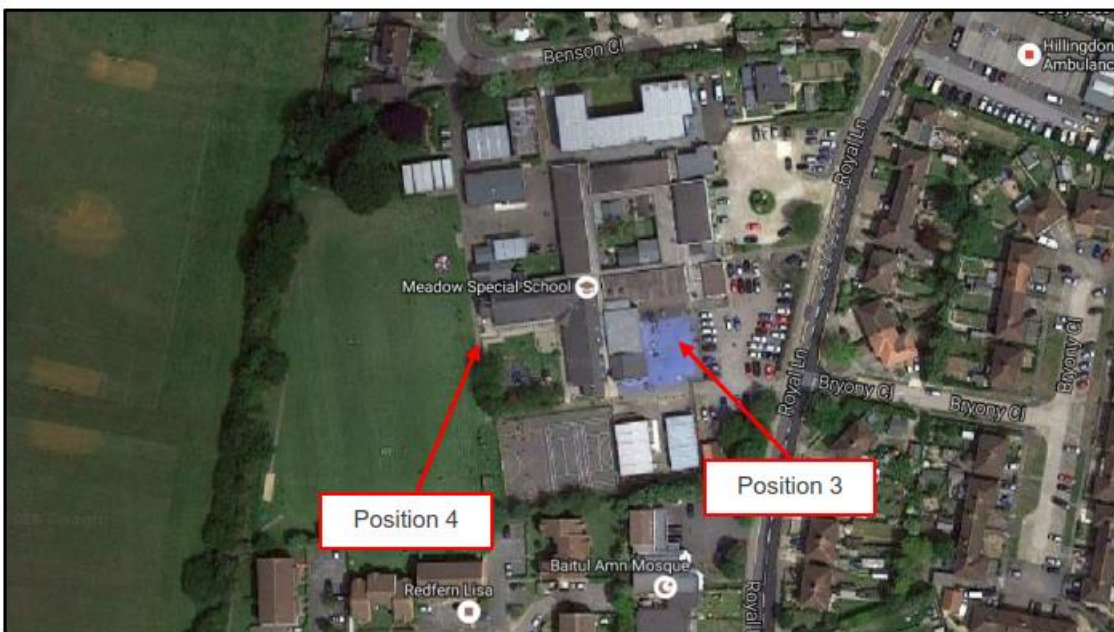


Figure 1: Hann Tucker short term noise monitoring positions.





6. Internal Ambient Noise Level from Environment

The Environmental Noise Survey undertaken by Hann Tucker Associates provides a summary of the noise levels measured during the attended noise survey as follows.

Table 4: Noise survey attended location measured noise levels

Position	$L_{Aeq,15min}$	$L_{1,15min}$
3	49	56
4	51	56

With regard to external noise control through natural ventilation BB93 states:

"Where external ambient free field noise levels at the façade expressed as the $L_{Aeq,30mins}$, do not exceed the IANL figures given in Table 1 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 the following noise levels are met for different room types these spaces can be naturally ventilated with either single sided or cross ventilation with the natural ventilation criteria being achieved. Where these levels are exceeded an attenuated hybrid or mechanical system will be required.

Table 2: External noise limits to achieve IANL with natural ventilation

BB93 IANL Upper Limit	Room type	External Noise Level Limit at room façade	
		Single sided vent	Cross ventilated
35 dB $L_{Aeq,30}$ minutes	New-build General Teaching Spaces	51 dB $L_{Aeq,30}$ minutes	55 dB $L_{Aeq,30}$ minutes
40 dB $L_{Aeq,30}$ minutes	Refurbished General Teaching Spaces	56 dB $L_{Aeq,30}$ minutes	60 dB $L_{Aeq,30}$ minutes

With the highest measured noise levels being 51dB $L_{Aeq,30}$ minutes it is demonstrated that the buildings can be naturally ventilated via open windows and therefore there is no adverse impact of environmental noise on the educational use of the development.

The site is therefore suitable for educational use in planning terms.

7. Environmental Noise Emission

There is potential for noise from building services plant to affect the residential amenity of neighbours and as such suitable noise limits should be imposed to avoid a significant adverse impact.

The Environmental Noise Survey undertaken by Hann Tucker Associates provides plant noise limits based on the long-term survey data and the local authority required assessment difference. The Rating Noise Level limits, when assessed at the location of noise sensitive receptors in accordance with BS4142:2014, are as follows:

Table 8: BS4142:2014 plant Rating Noise Level upper limits

Plant Noise Emission Criteria (dB re 2x10 ⁻⁵ Pa)		
Daytime (07:00 – 23:00 hours)	Evening (07:00 – 23:00 hours)	Night-Time (23:00 – 07:00 hours)
36	36	32

Plant will be designed, specified and assessed to demonstrate compliance with the above noise levels.



8. Appendix 1 – Glossary of Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \log_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.



Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Noise rating, NR – graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves.

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R (or SRI) – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected



back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

Weighted standardized impact sound pressure level, $L'_{nT,w}$ – single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies. The weighted standardized impact sound pressure level is used to characterize the insulation of floors in buildings (see BS EN ISO 717-2).

Weighted standardized level difference, $D_{nT,w}$ – Single-number quantity that characterizes the airborne sound insulation between rooms. The weighted standardized level difference is used to characterize the insulation between rooms in a building (see BS EN ISO 717-1).



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