



ST JAMES HOUSE

NOS. 6 - 8 OVERCLIFFE, GRAVESEND

KENT DA11 0EF

SCHOOL CONVERSION SCHEME

ACOUSTIC ASSESSMENT TO BUILDING BULLETIN 93

Report No. MRL/100/2153.1v1
March 2025

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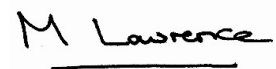
ACOUSTIC ASSESSMENT TO BUILDING BULLETIN 93

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A handwritten signature in black ink, appearing to read 'M. Lawrence', with a horizontal line underneath the name.

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1.0 INTRODUCTION

- 1.1 MRL Acoustics Ltd was commissioned by Tower Group Developments Ltd to provide acoustic engineering consultancy services in connection with a proposed school conversion development project at St James House, Nos. 6 - 8 Overcliffe, Gravesend, Kent DA11 0EF.
- 1.2 The project comprises the refurbishment of an existing 3-storey office building with basement level to form a new school facility with kitchen, dining rooms and offices in the basement level; 3 no. classrooms, offices and WCs on the ground floor level; 3 no. classrooms, meeting room and offices on the 1st floor level; and 2 no. classrooms and offices on the 2nd floor level.
- 1.3 We understand that the entire school is entirely for pupils with special educational needs (SEN).
- 1.4 This report covers the design issues raised in Building Bulletin 93, 'Acoustic Design of Schools : Performance Standards' – February 2015 (BB93) which is intended for new school developments.
- 1.5 Section 1 of the above document sets out the acoustic performance standards. The acoustic conditions in schools are controlled by Part E of the Building Regulations, School Premises Regulations and the Independent School Standards, which apply to new and existing schools.
- 1.6 The normal way of satisfying Requirement E4 of the Building Regulations, the School Premises Regulations and the Independent School Standards is to meet the appropriate performance standards in Section 1 of BB93.
- 1.7 The main areas of acoustic requirements in the document are as follows:-
- i) Control of noise transmission from one internal area to another;
 - ii) Control of break-in of external noise to teaching areas;
 - iii) Control of Reverberation Time in the teaching rooms and other areas.

- 1.8 The School Premises Regulations and the Independent School Standards apply to refurbishment work, and the acoustic standards for refurbishment works given in BB93 apply.
- 1.9 Where there is a need to upgrade the acoustic performance of an existing building or when refurbishment is undertaken for other reasons, then the refurbished elements should meet, as far as reasonably practicable, the acoustic performance given in these guidelines to satisfy the School Premises Regulations, the Independent School Standards and the Equality Act.
- 1.10 Although Building Regulations do not apply to all alteration and refurbishment work, it is desirable that such work should consider acoustics and incorporate upgrading of the acoustics as appropriate. In addition, Regulation 4 of the Building Regulations requires that any building work on an existing school should not make an existing requirement or contravention any worse than before building work was carried out.
- 1.11 The scheme layout plans are shown at the end of this report.
- 1.12 All recommendations are given for acoustic reasons only and compliance with other requirements (e.g. fire protection/structural integrity, etc.) must be checked by other specialist members of the design team.
- 1.13 The assessment report was prepared by Matthew Lawrence who has over 30 years' experience in the acoustic industry and an MSc and Diploma in Acoustics & Noise Control, and who is a Member of the Institute of Acoustics (IOA). MRL Acoustics Ltd is also a member of the Association of Noise Consultants (ANC).
- 1.14 Noise levels referred to in the text have been rounded to the nearest whole decibel (dB), as fractions of decibels are imperceptible.
- 1.15 An explanation of the various noise units, indices and acoustical terms used in this report is provided in Appendix I.

2.0 BB93 CRITERIA

Internal Ambient Noise Levels

2.1 BB93 states that indoor ambient noise level (IANL) within certain types of rooms should be no more than the following :-

- SEN Teaching Space: $\leq 30 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- SEN Calming Room: $\leq 35 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Resource/Break-out Area: $\leq 40 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Library: $\leq 40 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Sports Hall: $\leq 40 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Dining Room: $\leq 45 \text{ dB } L_{Aeq} (30 \text{ minutes})$

2.2 Guidance is given for ancillary spaces including:

- Offices and Staff Rooms $\leq 40 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Changing Areas $\leq 50 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Corridors; Stairwells; Coats $\leq 45 \text{ dB } L_{Aeq} (30 \text{ minutes})$
- Toilets and Kitchens: $\leq 50 \text{ dB } L_{Aeq} (30 \text{ minutes})$

2.3 BB93 states that where natural ventilation is proposed, the above Indoor Ambient Noise Levels (IANL) can be increased by up to +5 dB. The indoor ambient noise levels are taken as being the level experienced in the completed, unoccupied, unfurnished space. Therefore, any proposed ventilation strategy should be designed to ensure that the internal noise limits outlined above are achieved.

- 2.4 The noise limits apply to the break-in of external noise (e.g. road traffic) and noise from internal building services plant, but noise from teaching activities or equipment is excluded.
- 2.5 Noise levels measured at the rear of the building indicated that the existing external ambient noise climate was 45 dB L_{Aeq} (1-Hour). Therefore, allowing 15 dB(A) attenuation for an open window, the internal noise climate inside any classrooms on the rear part of the building will be approximately 30 dB L_{Aeq} which is within the criteria for the internal ambient noise levels outlined in paragraphs 2.1 and 2.2 of this report.
- 2.6 The proposed layout plans indicate that there are no SEN classrooms situated on the front elevation of the building and therefore the impact of noise from road traffic along the A226 Overcliffe road will not be an issue.

Airborne Sound Insulation Between Spaces

- 2.7 BB93 states the required sound insulation performance standards between rooms based on the activity noise level in the source room and the noise tolerance in the receiving room.
- 2.8 The required sound insulation values for the separating walls and floors have been calculated based on the classification of activity noise in the source room and the noise tolerance in the receiving room, as given in Table 1 of BB93 and summarised in Table 1 below:-

Table 1: Required Standards for Airborne Sound Insulation Between Rooms

Partition Type	Room 1	Room 2	Required Sound Insulation Performance	
			D_{nT} ($T_{mf,max}$),w (dB)	R_w (dB)
Wall	SEN Classroom	SEN Classroom	50	55
Wall	SEN Classroom	SEN One-to-One Room	50	55
Wall	SEN Classroom	Office/Meeting Room	45	50
Wall	SEN Classroom	WC	40	45
Wall	SEN Classroom	Circulation Space	40	45

Partition Type	Room 1	Room 2	Required Sound Insulation Performance	
			D _{nT} (T _{mf,max}),w (dB)	R _w (dB)
Floor	SEN Classroom	SEN Classroom	50	55

- 2.9 It should be noted that for design purposes, the airborne sound reduction performance for any walls and floors specified is usually defined as the R_w level which is the laboratory tested sound reduction performance. (Note:- for airborne sound insulation, the higher the figure the better the performance).
- 2.10 BB93 states that to achieve a suitable level of airborne sound insulation between **circulation spaces**, i.e. corridors and stairwells, etc. and **other spaces** used by students, any separating walls should have a minimum airborne sound insulation performance of at least **45 dB R_w** for SEN teaching spaces.
- 2.11 Any doors or doorsets in this type of separating wall should have a minimum sound reduction of at least **35 dB R_w**.

Impact Sound Insulation Between Spaces

- 2.12 BB93 also specifies the recommended maximum weighted BB93 standardised impact sound pressure level, L' _{nT(T_{mf,max}),w} for receiving rooms of different types and uses. These are summarised in Table 2 below:-

Table 2: Required Standards for Impact Sound Insulation of Floors

Type of Room (Receiving Room)	Maximum Weighted BB93 Standardised Impact Sound Pressure Level	
	L' _{nT (T_{mf,max}),w} (dB)	L _{n,w} (dB)
SEN Classroom	55	50
SEN One-to-One Room	60	55
Office	65	60
WCs	65	60
Circulation Space	65	60

- 2.13 It should be noted that for design purposes, the impact sound reduction performance for any floors specified is usually defined as the $L_{n,w}$ level which is the laboratory tested sound reduction performance. (Note:- for impact sound insulation, the lower the figure the better the performance).

Reverberation Time

- 2.14 Reverberation time of a space is a measure of the rate at which the sound decays and is defined as the time taken for the reverberant sound energy to decay corresponding to a 60 dB reduction in the sound level. The required reverberation times in the different types of room are set out in BB93.
- 2.15 Reverberation is controlled by adding more acoustically absorbent material thus reducing the build-up of reflected sound energy. Rooms with excessive reverberation times result in higher general noise levels and poor speech intelligibility. The required reverberation times for the rooms within the new school building are shown in Table 3 below:-

Table 3: Required Reverberation Times

Room Type	T_{mf} (Seconds)								
SEN Classroom	< 0.40 averaged from 125 Hz to 4 kHz octave-band centre frequencies and:- < 0.60 in every octave-band in this range								
SEN Calming Room	< 0.60								
Office	< 1.00								
Dining Hall	< 1.00								
Sports Hall	< 1.66 (based on 357m ² floor area) <table border="1"> <thead> <tr> <th>Floor area</th><th>Maximum T_{mf} seconds</th></tr> </thead> <tbody> <tr> <td><280 m²</td><td>1.5</td></tr> <tr> <td>280-530 m²</td><td>2.0 – ((530-floor area)/500)</td></tr> <tr> <td>>530 m²</td><td>2.0</td></tr> </tbody> </table>	Floor area	Maximum T_{mf} seconds	<280 m ²	1.5	280-530 m ²	2.0 – ((530-floor area)/500)	>530 m ²	2.0
Floor area	Maximum T_{mf} seconds								
<280 m ²	1.5								
280-530 m ²	2.0 – ((530-floor area)/500)								
>530 m ²	2.0								
WC	< 1.50								
Corridor/Stairwell *	^								

^ The amount of absorption required should be calculated according to Approved Document E, Section 7. This describes 2 calculation methods, A and B, for controlling reverberation in the common internal parts of domestic buildings. Either of these methods can be used to determine the amount of absorption required in corridors, entrance halls and stairwells in schools.

- 2.16 The reverberation times in Table 3 are quoted in terms of the mid-frequency reverberation time, T_{mf} which is the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands, or the arithmetic average of the reverberation times in the one-third octave bands from 400 Hz to 2.5 kHz (although these are not mathematically equivalent, in practice the difference will be small and in the interests of simplicity and ease of measurement, either is acceptable).
- 2.17 For SEN teaching spaces, the required RT is expressed as the arithmetic average of the RT in the 125 Hz to the 4 kHz octave-bands, or the arithmetic average of the RTs in the one-third octave-bands from 100 Hz to 5 kHz.
- 2.18 Although the RT requirements in Table 6 of Building Bulletin 93 are for unoccupied rooms, it is important to remember that the occupants will present a significant amount of absorption which will be in the lower half of the room. Acoustic absorption is, therefore, often located at high level on the ceilings and walls to give a reasonably even distribution of absorptive material.

Rain Noise

- 2.19 The design of the roof of the proposed school building should ensure that rain noise is adequately attenuated. The Building Regulation submission should demonstrate that lightweight roofs and any roof glazing have been designed to provide suitable control of rain noise. The reverberant sound pressure level in a space (calculated using laboratory test data with 'heavy' rain noise excitation as defined in BS EN ISO 140-18 [Ref.13]) should not be more than 25 dB above the appropriate indoor ambient noise levels given in Table 1 of BB93.
- 2.20 Suitable treatments that can be used in combination to provide sufficient resistance to impact sound from rain on the roof are:-

- damping of profiled metal roofing systems;
- cladding (e.g. using commercial damping materials);
- use of dense mineral wool insulation in the roof build-up;
- independent ceilings below the lightweight roof.

2.21 The provision of sound absorbing ceiling linings will also assist in attenuating any rain noise impact within the classrooms and other educational spaces.

2.22 All of the existing ceilings in all rooms throughout the building already have suspended MF ceilings with sound-absorbing ceiling tiles.

2.23 In this case, it is considered that the existing tiled roof and top floor plasterboard ceilings with the suspended MF ceilings with sound-absorbing tiles below, will be sufficient to ensure that rain noise is attenuated to a level that does not exceed the +25 dB limit for the indoor ambient noise levels given in Table 1 of BB93.

External Noise Impact

2.24 We understand that the proposed school will not be provided with any additional mechanical ventilation or items of external building services plant.

2.25 Therefore, it is considered that there will be no impact on the ambient noise climate at the nearest residential properties to the site arising from the change of use from a commercial office to a school and no assessment for plant noise needs to be considered.

2.26 We also understand that there will be no external school playground area and therefore noise from this will not be an issue.

2.27 Noise from any staff cars or parents cars dropping off and collecting pupils will also not be an issue as the majority of this will occur at the front of the building where the dominant noise source is from road traffic noise along the A226 Overcliffe road.

3.0 RECOMMENDED SPECIFICATIONS

Separating Walls

- 3.1 We understand that all of the separating walls between the classrooms and other classrooms, including those separating classrooms from other room types, are to consist of the existing separating walls with no new separating walls being constructed.
- 3.2 It is considered that the existing separating walls between the SEN Classrooms, corridors and other spaces, are deemed to be acceptable in terms of airborne sound insulation and should achieve the minimum BB93 sound insulation requirements outlined in Table 1 of this report.
- 3.3 Any holes or penetrations through these walls must be as small as possible and completely sealed with dense material and flexible mastic.
- 3.4 Any service penetrations must be well sealed, and any pipes and cables wrapped in at least 50mm dense mineral wool insulation and boxed in using at least 2 layers of 15mm thick SoundBloc plasterboard on an independent timber or metal stud frame.

Separating Floors

- 3.5 We understand that all of the separating floors between each level of the building are to consist of the existing separating floors, which consist of timber joist floors with acoustic suspended MF ceilings below.
- 3.6 Every room in the building is to either have the existing carpets retained or provided with similar thick pile carpets.
- 3.7 It is considered that the existing separating floors between the SEN Classrooms, corridors and other spaces, are deemed to be acceptable in terms of airborne sound insulation and should achieve the minimum BB93 requirements outlined in Table 1 of this report.

- 3.8 As long as the existing carpets are retained (or replaced with one of a similar depth), then it is considered that the existing separating floors between the SEN Classrooms, corridors and other spaces, are deemed to be acceptable in terms of impact sound insulation and should achieve the minimum BB93 requirements outlined in Table 2 of this report.
- 3.9 Any service penetrations through the party floors will affect sound insulation. All voids around any pipes should be well sealed.
- 3.10 Pipes should be wrapped with at least 25mm thick mineral wool quilt (minimum density 10 kg/m³) to isolate them from the floor/ceiling and boxed in with 2 layers of 15mm thick SoundBloc plasterboard (or similar dense plasterboard with a combined nominal mass per unit area of at least 20 kg/m²) fitted on an independent timber or metal stud frame, i.e. the plasterboard linings and framework should not touch the pipework.
- 3.11 Any exposed steel beams or columns should be wrapped in at least 50mm thick mineral wool insulation and boxed-in using 2 layers of 15mm thick SoundBloc plasterboard (or similar dense plasterboard with a combined nominal mass per unit area of at least 20 kg/m²) fitted on an independent timber or metal stud frame, i.e. the plasterboard linings and framework should not touch the steelwork.

Doors

- 3.12 For circulation spaces, i.e. corridors and stairwells, etc. and other spaces used by students, that comprise a composite wall construction, i.e. a wall that contains a door, the minimum acceptable airborne sound insulation performance level is 45 dB R_w.
- 3.13 Any doors and doorsets in these separating walls should have a minimum sound reduction of at least **35 dB R_w**.
- 3.14 To achieve these levels of sound reduction performance, it may be necessary to provide acoustic doors seals around the perimeter and the threshold.

- 3.15 The performance of any new doors should be checked against the manufacturer's details to ensure that the required R_w performance includes the complete doorset, including the perimeter seals.

Building Services Mechanical Plant

- 3.16 No information relating to proposed plant or other machinery within the plant room is available at this stage. However, as a minimum requirement we recommend that any reciprocating plant and associated ductwork is mounted on suitable anti-vibration mounts and that any mechanical services are designed to be as quiet as possible.
- 3.17 Any proposed building services plant must be designed to ensure that the internal noise limits within classrooms and other educational spaces does not exceed 35 dB L_{Aeq} (30 Minutes) when operating at typical capacity.
- 3.18 For design purposes, it should be noted that noise from building services plant should be designed to achieve NR 30 or lower in order to ensure the 35 dB(A) noise limit is not exceeded.
- 3.19 Any external Air Conditioning Units or other Condenser Units should be carefully positioned so as not to affect any classrooms or other noise-sensitive educational areas.
- 3.20 Further calculations may be necessary when detailed information becomes available to determine whether any other specific noise control measures will be required.

Control of Reverberation

- 3.1 T_{mf} is the RT60 within a space and is the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands, or the arithmetic average of the reverberation times in the one-third octave bands from 400 Hz to 2.5 kHz. These are the frequencies used for speech and by controlling reverberation at these frequencies, speech intelligibility can be improved.

- 3.2 For SEN teaching spaces, the required RT is expressed as the arithmetic average of the RT in the 125 Hz to the 4 kHz octave-bands, or the arithmetic average of the RTs in the one-third octave-bands from 100 Hz to 5 kHz.
- 3.3 It is considered that with the retention of both the existing suspended MF ceilings with the sound-absorbing ceiling tiles and also the carpets in each teaching space, that the required RT in each type of room space outlined in BB93 and Table 3 of this report should be achieved.
- 3.4 Within BB93 there are no mandatory reverberation criteria for corridors and stairwells. The amount of absorption required should be calculated according to Approved Document E, section 7. This describes 2 no. calculation methods, A and B, for controlling reverberation in the common internal parts of buildings. Method A states that for entrance halls, corridors or hallways, cover an area equal to or greater than the floor area with a Class C absorber or better.
- 3.5 We understand that the existing sound-absorbing ceiling tiles in the corridors and other communal spaces are to be retained, and it is considered that the existing ceiling tiles in the suspended MF ceiling system will comply with Method A outlined above and therefore provide adequate levels of RT in these areas.

4.0 SUMMARY & CONCLUSIONS

- 4.1 An acoustic assessment has been carried out for the proposed SEN school conversion scheme at St James House, Nos. 6 - 8 Overcliffe, Gravesend, Kent DA11 0EF, in accordance with the design issues raised in Building Bulletin 93, 'Acoustic Design of Schools' (BB93).
- 4.2 We have assessed the level of noise break-in and the internal ambient noise climate within classrooms and other educational spaces and the required sound insulation performance requirements for the separating walls and floors in accordance with the design requirements of BB93.
- 4.3 The assessment has also included the acoustic absorption provided by the existing suspended acoustic ceiling tiles which will ensure that the reverberation time (RT) in each relevant space is achieved in order to meet the BB93 requirements.
- 4.4 Any mechanical ventilation should be designed so that the internal noise limits are not exceeded.
- 4.5 As long as the detailing aspects recommended in this report are implemented fully, the school development scheme building will generally satisfy the requirements of Building Bulletin 93.

APPENDIX I – NOISE UNITS & INDICES

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

b) Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

c) **A-weighting**

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBLA.

d) **Glossary of Terms**

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below together with a glossary of terms.

Reverberation Time

The reverberation time (RT60) is the time taken for the sound pressure level (SPL) to reduce by 60 dB when the sound source is instantaneously cut off. Rooms with many hard surfaces are very reverberant and have long reverberation times. Rooms with many acoustically absorbent finishes tend to have short reverberation times because the sound decays rapidly. T_{mf} is the RT60 within a space averaged across the 500 Hz, 1 kHz and 2 kHz octave bands. These are the frequencies used for speech and by controlling reverberation at these frequencies, speech intelligibility can be improved.

L_{eq} This is the 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{eq} is the level of a continuous noise which has the same total energy as the real fluctuating noise, measured over the same time period.

- B_g The receiver room background noise level, L_{eq} .
- RT Measured reverberation time in receiver room in seconds.
- RT_0 Standard reverberation time of 0.5 seconds.
- R_w The laboratory tested weighted sound reduction index result of a material or building element under ideal test conditions, i.e. no flanking noise included.
- $L_{n,w}$ The laboratory tested weighted impact sound reduction result of a material or building element under ideal test conditions, i.e. no flanking noise included.
- D Level difference, effectively $D = \text{source level} - (\text{receiver level corrected for } B_g)$.
- D_{nT} Standardised level difference, standardised to a receiver room reverberation time of 0.5 seconds, $D_{nT} = D + 10 \log (RT/RT_0)$.
- $D_{nT,w}$ Weighted standardised level difference, a single figure generated by comparing the D_{nT} with a reference curve. The reference curve is shifted in 1 dB steps until the sum of adverse deviation of the test curve, compared to the reference curve, is as large as possible, but no more than 32.0 dB. The value of the shifted reference curve at 500 Hz is taken as the $D_{nT,w}$. N.B. As $D_{nT,w}$ for airborne transmission represents a level difference, an improvement generates a larger figure.

$D_{nT(T_{mf,max})}$

Standardised level difference, standardised to the maximum permitted receiver room T_{mf} .

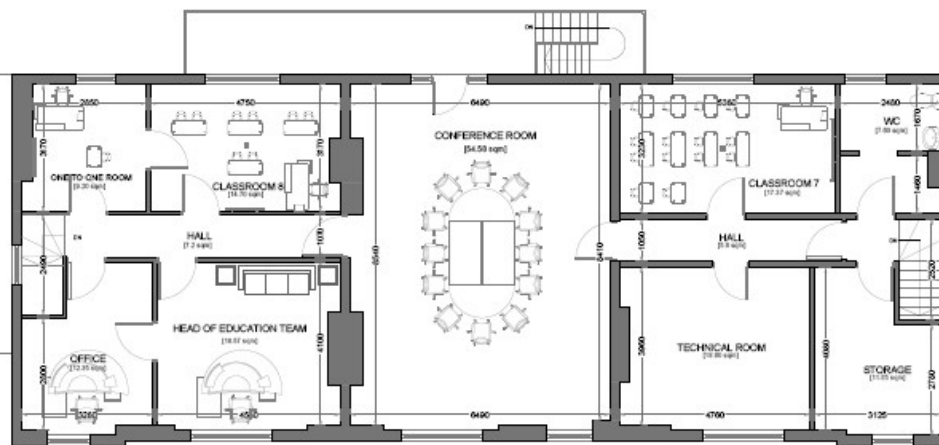
$$D_{nT(Tmf\ max),\ w}$$

Weighted standardised level difference, a single figure generated by comparing the $D_{nT(Tmf,\max)}$ with a reference curve. The reference curve is shifted in 1 dB steps until the sum of adverse deviation of the test curve, compared to the reference curve, is as large as possible, but no more than 32.0 dB. The value of the shifted reference curve at 500 Hz is taken as the $D_{nT(Tmf\ max),\ w}$. N.B. As $D_{nT(Tmf\ max),\ w}$ represents a level difference, an improvement generates a larger figure.

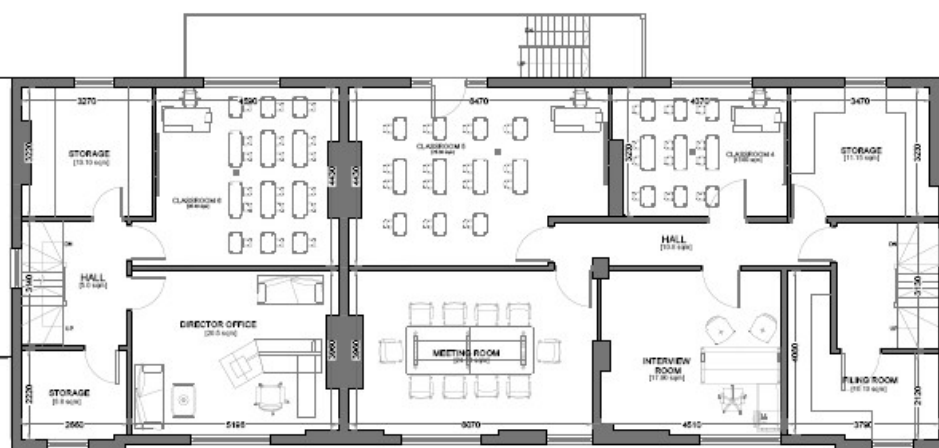
$$L'_{nT,\ w}$$

Weighted standardised impact sound pressure level, a single figure index used to describe the in-situ impact sound insulation performance of a floor. $L'_{nT,\ w}$ is determined by first measuring the amount of sound energy resulting beneath a floor (in one-third octave bands) produced by a specialised piece of equipment called a tapping machine. The tapping machine (as used in the UK) comprises of five hammers which are lifted and dropped at a precise frequency by a rotating camshaft. The one-third octave band levels measured beneath the floor are termed the impact sound pressure level, L_i . A correction for the acoustic character of the receiving room is then applied yielding the standardised impact sound pressure level, L'_{nT} . The one-third octave band L'_{nT} values are then plotted on a graph and a reference curve fitted. $L'_{nT,\ w}$ is the L'_{nT} value on the reference curve corresponding to 500 Hz.

APPENDIX II – PROPOSED LAYOUT PLANS



Proposed Second Floor Plan
1 : 100



Proposed First Floor Plan
1 : 100

