

PROPOSED NEW CLASSROOM BLOCK AT LORETO COLLEGE, MANCHESTER

RIBA STAGE 3: ACOUSTIC DESIGN REVIEW

On behalf of:
Loreto Sixth Form College

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1.0 INTRODUCTION

- 1.1 Hepworth Acoustics Ltd was commissioned by '10architects', on behalf of Loreto Sixth Form College, to provide acoustic consultancy services in connection with a proposed new classroom block at their college campus off Chichester Road South, Manchester.
- 1.2 This acoustic design review has been prepared as part of RIBA Stage 3 of the design process, with respect to the following considerations:
- Control of internal ambient noise levels, due to break-in of external noise;
 - Airborne sound insulation of walls and floors, and impact sound insulation of floors;
 - Control of reverberation of sound within relevant spaces;
 - Setting upper design limits for building services/plant noise; and,
 - Initial comments on control of rain noise.
- 1.3 The new classroom block is to be located to the south of the campus at the corner of Chichester Road South and Moss Lane West. The development layout of the proposed classroom block is shown in Figure 1.
- 1.4 The plans and drawings on which this acoustic design review are based, have been provided by '10architect'.
- 1.5 All recommendations in this report are provided with respect to acoustic performance only and compliance with other requirements (e.g. fire, structural and ventilation etc.) should be checked by others.
- 1.6 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 BB93:2015 ACOUSTIC DESIGN GUIDANCE

- 2.1 Loretto college is classified as a sixth form college, and therefore there is no statutory requirement to meet any particular acoustic performance standards. However, BB93:2015 'Acoustic Design of Schools: Performance Standards', which applies to new schools, and which provides useful guidance on acoustic design of education buildings, has been used as design guidance for the purposes of determining appropriate guideline acoustic criteria for this development.
- 2.2 The acoustic performance standards of BB93:2015 provide acoustic performance criteria for each room type, and are determined by the room usage as defined in Tables 1 of BB93:2015. The document was published in 2014 but a number of updates were issued in 2015. In this report we have referred to the document as BB93:2015 as it takes account of the updates.
- 2.3 For the purposes of this assessment, the rooms in the new classroom block have been classified as shown in Table 1 of this report.
- 2.4 Acoustic conditions in administration and ancillary spaces not used for teaching and learning are not critical except where they affect conditions in neighbouring teaching and learning spaces.

Room Use Designations, Indoor Ambient Noise Levels and Reverberation Times

- 2.5 The adopted BB93 room types for each space within the proposed classroom block, along with the upper limits for Indoor Ambient Noise Level (IANL) under normal conditions for mechanically ventilated spaces and reverberation time (RT) targets, are shown in Table 1 overleaf.

Table 1: Adopted Acoustic Performance Targets (IANL, RT)

Internal Space	BB93 Table 1 Room Type	Activity noise (Source room)	Noise tolerance (Receiving room)	Upper limit for the indoor ambient noise level dB $L_{Aeq,30\text{ min}}$	Upper limit for Reverberation Time $s T_{mf}$
Teaching and Learning Spaces					
Classroom	Classroom	Average	Medium	35	0.8
Assembly	Assembly Hall	Average	Medium	35	0.8 – 1.2
Study Centre	Open Plan: Resource/breakout area	Average	Medium	40	1.2
Administration and Ancillary Spaces					
Circulation	Corridor, stairwell	Average	High	50	ADE Methodology
Stair	Corridor, stairwell	Average	High	50	ADE Methodology
WC	Corridor, stairwell	Average	High	50	1.5
Staffroom	Office	Low	Medium	40	1
Plant Room	N/A	Very High	High	N/A	N/A

- 2.6 Also, and where relevant, in order to protect students from regular discrete noise events, e.g. aircraft or trains, IANLs should be controlled so as not to exceed 60 dB $L_{A1,30\text{ min}}$ in teaching spaces.
- 2.7 Where rooms are proposed that do not have corresponding BB93 designations we have adopted activity noise and noise tolerance values as considered appropriate.
- 2.8 The IANL targets exclude noise contribution from rain noise. However, BB93:2015 states that IANL during heavy rain (as defined in BS EN ISO 140-18) should be controlled to no more than 25 dB above the IANL targets in Table 1.
- 2.9 There is no requirement to achieve the IANL or RT criteria in administration and ancillary spaces.
- 2.10 Where spaces are to be naturally ventilated or ventilated via a hybrid system, relaxation of the IANL targets are applicable. The corresponding IANL tolerances are shown in Table 2 overleaf.

Table 2: Summary of IANL Tolerance/Limits for Hybrid and Natural Ventilation System

Condition	Ventilation System	IANL Limit
Normal - Ventilation for normal teaching and learning activities	Mechanical	Table 1-3 values
	Natural	Table 1-3 values + 5 dB*
	Hybrid	Mechanical system noise: Table 1-3 values Total noise level: Table 1-3 value +5 dB
Summertime - ventilation under local control of teacher to prevent overheating	Mechanical	Table 1-3 value +5 dB*
	Natural / Hybrid	≤55 dB
Intermittent Boost - ventilation under local control of teacher to provide dilution of fumes	Mechanical	Table 1-3 value +5 dB*
	Natural	≤55 dB

*Does not apply to teaching and learning spaces where the Table 1 IANL is equal to or greater than 45 dB.

Control of Reverberation in Circulation Spaces

- 2.12 The purpose of controlling reverberation of sound in circulation spaces (i.e. corridors and stairs) is so that it does not interfere with teaching and study activities in adjacent rooms. is dealt with separately in BB93 because measurements of RT in spaces with these types of shapes can be unpredictable. The control of reverberation noise in corridors and circulation areas is achieved via installation of prescribed amounts (i.e. areas) of acoustic absorption material rather than by achieving any specific reverberation time targets.
- 2.13 Method A of the Building Regulations Approved Document E requires that:
- for corridors, an area equal to or greater than the floor surface area should be covered with a Class C absorber or better. This is generally achieved with a suitable Class C ceiling tile.
 - for stairwells (or stair enclosures) calculate the combined area of the stair treads, the upper surface of landings and intermediate landings, and the ceiling area of the top floor. Either cover an area equal to this calculated area with a Class D absorber or cover an area equal to at least 50% of this calculated area with a Class C absorber or better.
- 2.14 Sound absorption coefficient values (rated in accordance with international standard EN ISO 11654) for each Class of absorber are shown in Table 3 overleaf. Class A absorbers provide more acoustic absorption than Class B.

Table 3: Minimum Absorption Class Coefficient Values

Absorption Class	Sound Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
A	0.7	0.9	0.9	0.9	0.9	0.8
B	0.6	0.8	0.8	0.8	0.8	0.7
C	0.4	0.6	0.6	0.6	0.6	0.5

Sound Insulation of Walls and Floors Separating Teaching Spaces and Other Spaces

- 2.15 BB93:2015 states the required airborne sound insulation performance standards of walls and floors separating spaces, based on the activity noise level in the source room and the noise tolerance in the receiving room. We have used the room types adopted for the various proposed spaces in Table 1 to determine the sound insulation requirements of separating partitions and floors.
- 2.16 The sound insulation requirements are calculated in both directions between adjacent teaching spaces, and where a teaching space is adjacent to an administration and ancillary space. There is no requirement to achieve any given sound insulation performance between administration and ancillary spaces, or from teaching spaces to ancillary spaces, but sound transmission from ancillary spaces to teaching spaces should be suitably controlled.
- 2.17 Stores and cleaner cupboards are not noise sensitive nor do they generate noise, therefore it is not necessary to specify sound insulation performances between stores/cleaner cupboards and other spaces unless the store contains a source of potential noise generation such as an extract fan cupboard.
- 2.18 The sound insulation performance targets adopted for separating walls that do not contain a door are detailed in Table 4.

Table 4: Adopted Sound Insulation Performance Targets for Separating Walls

Internal Spaces Separated by a Wall (with no door)		Airborne Sound Insulation Performance dB $D_{nT,w}$
Classroom	Classroom	45
Assembly	WC	50
Stair	Classroom	45
Staffroom	Classroom	45
WC	Classroom	45
Store/Riser/Lift	Classroom	45

- 2.19 Where there are teaching/learning spaces which are directly linked to another occupied room via a door, the minimum sound insulation rating of the doorset must be 35 dB R_w and the wall containing the door must have a minimum performance of 45 dB R_w .
- 2.20 The airborne sound insulation targets between spaces separated by a floor are shown in Table 5, which have been determined based on their room uses.

Table 5: Adopted Airborne Sound Insulation Performance Targets for Separating Floors

Internal Spaces Separated by a Floor		Airborne Sound Insulation Performance dB $D_{nT,w}$
Classroom	Classroom	53
Staffroom	Classroom	54

Sound Insulation of Walls Separating Teaching Spaces and Circulation Spaces

- 2.21 BB93:2015 Table 4a gives the required performance standard of sound insulation between circulation spaces and teaching spaces used by students that are separated by a door and/or wall containing any glazing with no ventilator in the wall/door, and is reproduced for relevant spaces in Table 6.

Table 6: Performance Standards for Airborne Sound Insulation Between Circulation Spaces and Teaching Spaces, with no Ventilator in the Wall

Room Classification	Minimum R_w (dB)	
	Composite R_w of Wall <u>and</u> Glazing	Doorset
	New Build	
All other rooms used for teaching or learning	40	30

- 2.22 BB93:2015 Table 4b gives the required performance standard of sound insulation between circulation spaces and teaching spaces used by students that are separated by a door and/or wall containing any glazing, that do contain a ventilator in the wall/door, and is reproduced for relevant spaces in Table 7.

Table 7: Performance Standards for Airborne Sound Insulation Between Circulation Spaces and Teaching Spaces, with a Ventilator in the Wall

Room Classification	Minimum R_w (dB)		Alternative to composite R_w of wall, glazing and ventilators dB, provided values in Table 4a are provided by wall, glazing and doors
	Composite R_w of Wall and Glazing	Doorset	Minimum $D_{n,e,w} - 10\lg N$ dB for ventilators
	New Build		
All other rooms used for teaching or learning	33	30	32

Impact Sound Insulation of Floors Separating Teaching Spaces and Other Spaces

- 2.23 BB93:2015 provides impact sound insulation performance standards of floors for receiving rooms of different types and uses. We have taken the room types as set out in Table 1 to determine the sound insulation requirements of separating floors between spaces. The design assessment of $L'_{nT,w}$ is considered into the room via the floor above. The sound insulation performance target adopted for separating floors above classrooms is stated in Table 8.

Table 8: Adopted Impact Sound Insulation Performance Targets for Separating Floors

Internal Space	Maximum impact sound pressure levels $L'_{nT,w}$
Classroom	60

3.0 CONTROL OF INDOOR AMBIENT NOISE LEVELS (IANL)

- 3.1 IANL within a space is taken as being the noise level experienced in the completed, unoccupied, unfurnished space due to the break-in of external noise and any noise from building services. Noise from teaching activities or teaching equipment is excluded.
- 3.2 An environmental noise survey was carried out in March 2023, the results of which are provided in full in our Stage 2 planning noise assessment report (P23-075-R01v1). A summary of the average external noise levels is shown in Table 9 below.

Table 9: Ambient Noise Levels (dB)

Description	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
$L_{eq,T}$	70	63	59	59	57	54	46
$L_{1,T}$	73	65	61	61	62	58	49

- 3.3 Based on the ambient noise levels that were measured at the location of the new classroom block (shown in Table 9) means that the IANL can be achieved with slightly enhanced acoustic glazing. An acoustically attenuated form of natural/passive ventilation, or a mechanical ventilation system, will also be required to maintain internal noise levels.

Building Envelope Proposals & Recommendations

External Walls

- 3.4 External walls will be of cavity masonry construction with outer facing 102mm clay brickwork and 140mm dense blockwork inner leaf with plaster finish.

Glazing

- 3.5 In general, the resulting noise levels inside teaching spaces and non-teaching spaces away from Chichester Road South and Moss Lane West would meet the relevant BB93 IANL values with windows of standard well-fitted thermal double glazing (4mm glass - 4mm glass) i.e. windows having a typical sound reduction performance of 25 dB $R_w + C_{tr}$ when the windows are closed.
- 3.6 However, to adequately control noise break-in to achieve the internal ambient noise levels in teaching spaces overlooking Chichester Road South and Moss Lane West enhanced acoustic glazing

would be necessary. Well fitted windows of minimum 8 mm glass – 12 to 20 mm cavity – 4 mm glass i.e. having a typical sound reduction performance of 30 dB $R_w + C_{tr}$ would control noise break-in to meet the relevant BB93 IANL values.

Ventilation

- 3.7 Mechanical ventilation systems or an acoustically attenuated form of natural/passive ventilation would be appropriate for the new building.

Noise from Building Services

- 3.8 The resulting internal ambient noise levels in spaces will be due to a combination of ingress of external noise and noise from any building services equipment. As such, where rooms will not be significantly affected by external noise ingress, the M&E noise levels can be specified to meet the adopted internal ambient noise level criteria in Table 1.
- 3.9 ‘Noise rating’ is a graphical method for assigning a single-number rating to a noise spectrum. It can be used to specify the maximum acceptable level in each octave band of a frequency spectrum, or to assess the acceptability of a noise spectrum for a particular application. The method was originally proposed for use in assessing environmental noise, but it is now used in the UK mainly for describing noise from mechanical ventilation systems in buildings. Whilst there is no direct relationship between NR and dB(A) values (such as noise levels denoted in terms of $L_{Aeq,T}$), the following approximate relationship applies: $dB(A) \approx NR + 6$
- 3.10 On this basis, we therefore recommend that M&E noise levels should be controlled to a value no higher than the NR value that is at least 9 dB below the corresponding adopted internal ambient noise levels in Tables 1, M&E noise design limits for relevant spaces are set out in Table 10 below.

Table 10: M&E noise design limits (dB)

Room	NR value
Classroom	26
Assembly	31
Study Centre	31
Staffroom	31

- 3.11 As discussed in Section 5 of our Stage 2 report (P23-075-R01v1), there will be some new external fixed plant proposed as part of the development, located in the roof top plant deck. However, there are no details of the noise emissions from this equipment at this stage.

- 3.12 Outline mitigation measures have been proposed within the Stage 2 report to adequately control noise from the external fixed plant at residential locations.
- 3.13 However, it is also important to note that the externally mounted plant may also need to be controlled to within suitable noise levels to ensure that there is no adverse effect on teaching spaces within the building itself.

Rain Noise

- 3.14 In line with the BB93 design criteria, rain noise within a teaching and learning space should be controlled to be no higher than 25dB above the IANL criteria given in Table 1. Rain noise insulation of a light-weight roof structure is not readily predictable and should be based on empirical test data (dB L_{IA}) carried out in line with ISO 140-18:2006, from which the internal rain noise levels can then be calculated.
- 3.15 We understand that the proposed roof construction will be 150mm concrete slab with rigid thermal insulation. This is likely to be more than sufficient to control rain noise within teaching spaces. Nevertheless, the final proposals should be reviewed in more detail at Stage 4, ideally when rain noise test data for the proposed roof will be available.

4.0 SOUND INSULATION BETWEEN SPACES

Airborne Sound Insulation of Separating Walls & Doors

- 4.1 It should be noted that the laboratory airborne sound insulation specification (in terms of R_w) is always higher than the in-situ airborne sound insulation that is actually achieved on site. For the avoidance of doubt, a 45 dB R_w wall will not provide an in-situ airborne sound insulation of 45 dB $D_{nT,w}$ on site, as the former is an acoustic laboratory test value and limiting factors due to on-site conditions reduce the overall airborne sound insulation in situ.
- 4.2 Typically, on-site sound level differences ($D_{nT,w}$) can be around 7 dB below that of the laboratory test value (R_w) under good conditions, but the difference can be as high as 12 dB depending on flanking sound transmission conditions. Therefore, the sound insulation performance recommended for walls and floors separating spaces should be taken as a minimum required performance.
- 4.3 We have calculated the minimum required laboratory sound insulation performance of walls (R_w) in order to meet the sound level difference targets between spaces ($D_{nT,w}$) based on the room volumes, surface areas of the shared partition and reverberation times.
- 4.4 The required laboratory sound insulation performance values for the separating walls within the building range between 47 and 51 dB R_w , with the majority of rooms requiring 50 dB R_w .
- 4.5 We understand that internal walls are proposed to be 140mm dense blockwork with 15mm plaster/skim finish, which would typically have a laboratory sound insulation performance of 48-51 dB R_w . This leaves very little margin of safety and may require additional independent plasterboard wall linings between some spaces. The proposed internal walls could be re-designed in order to provide the required sound insulation performance within an appropriate wall thickness.
- 4.6 The minimum recommended laboratory sound insulation performance values for walls and doors are shown in Figures 2, 3 and 4, for the ground, first and second floors respectively.
- 4.7 Although the minimum performance value for walls containing doors between teaching spaces and circulation spaces is 40 dB R_w for this development, we would nevertheless recommend installing partitions with a performance rating value of 45 dB R_w or above.

- 4.8 The proposed ventilation strategy should be reviewed at Stage 4 in order to control noise transmission between spaces via ductwork or for the specification of ventilation grilles proposed within circulations spaces, etc.

Airborne and Impact Sound Insulation of Separating Floors

Proposed Floor/Ceiling Construction

- 4.9 The proposals for the floor construction are for a 150mm cast in-situ concrete structural floor with vinyl floor tiles on top.
- 4.10 Proposals for the ceiling are currently for a lay-in grid metal frame and mineral tile ceiling, but the exact ceiling tile and grid is not currently specified. The ceiling will cover approximately 90% of the floor area with gaps around the edges.

Airborne & Impact Sound Insulation of Floors

- 4.11 The required airborne sound insulation criteria between spaces separated by floors are up to 54 dB $D_{nT,w}$. A concrete slab without an acoustic floating floor on top and an open ceiling below will not meet the required sound insulation performance in terms of airborne or impact requirements.
- 4.12 This will likely need to be re-designed to include an acoustic floating layer such as an appropriate screed finish on a specialist acoustic resilient isolating layer. It may also be appropriate that a mass barrier ceiling is installed underneath the concrete slab with a minimum mass per unit area of 10 kg/m² suspended via acoustically resilient hangers and laid with 100mm mineral wool in the cavity above.
- 4.13 The proposed mineral tile ceiling could be suspended underneath this acoustic ceiling.
- 4.14 Please note that any penetrations for lighting/services etc. are likely to reduce the sound insulation performance of the ceiling.

Flanking Sound Transmission

- 4.15 Advice on acoustic detailing and control of flanking sound transmission will be provided in our Stage 4 review which will take into account the latest proposals will include the following:
- General advice on acoustic detailing.

- Review of and advice regarding wall/wall as well as wall/soffit junction details.
- Steel beam/column encasements. We understand that the steel beams and columns will need to be encased to provide fire protection, but the detailed proposals are not currently available to review.

5.0 CONTROL OF REVERBERATION

5.1 The reverberation time criteria for the new block based on room use are shown in Table 1 of Section 2. As discussed in Section 2, suitable control of reverberation within circulation spaces can be achieved by covering a surface area equal to the surface area of the floor with a Class C absorber such as by installing a ceiling tile with Class C acoustic absorption and we recommend this approach.

5.2 For teaching areas we have carried out calculations to determine the required acoustic absorption within the relevant classroom spaces and provided recommendations for minimum absorption Class for acoustic ceiling tiles. Our recommendations with respect to control of reverberation are provided below:

- For classrooms we recommend installing a ceiling with a minimum Class C acoustic absorption and covering at least 90% of the ceiling surface area.
- For study centre we recommend installing a ceiling with a minimum Class C acoustic absorption and covering at least 90% of the ceiling surface area.
- For the Assembly space we recommend installing a ceiling with a minimum Class C acoustic absorption and covering at least 90% of the ceiling surface area, however due to the height of the space 6.5 metres, it is recommended that at least 30% of the wall area is covered with Class A acoustic absorption. The proposed walling covering should be in the lower section of the walls (i.e. closer to occupants) and evenly spaced throughout the space.

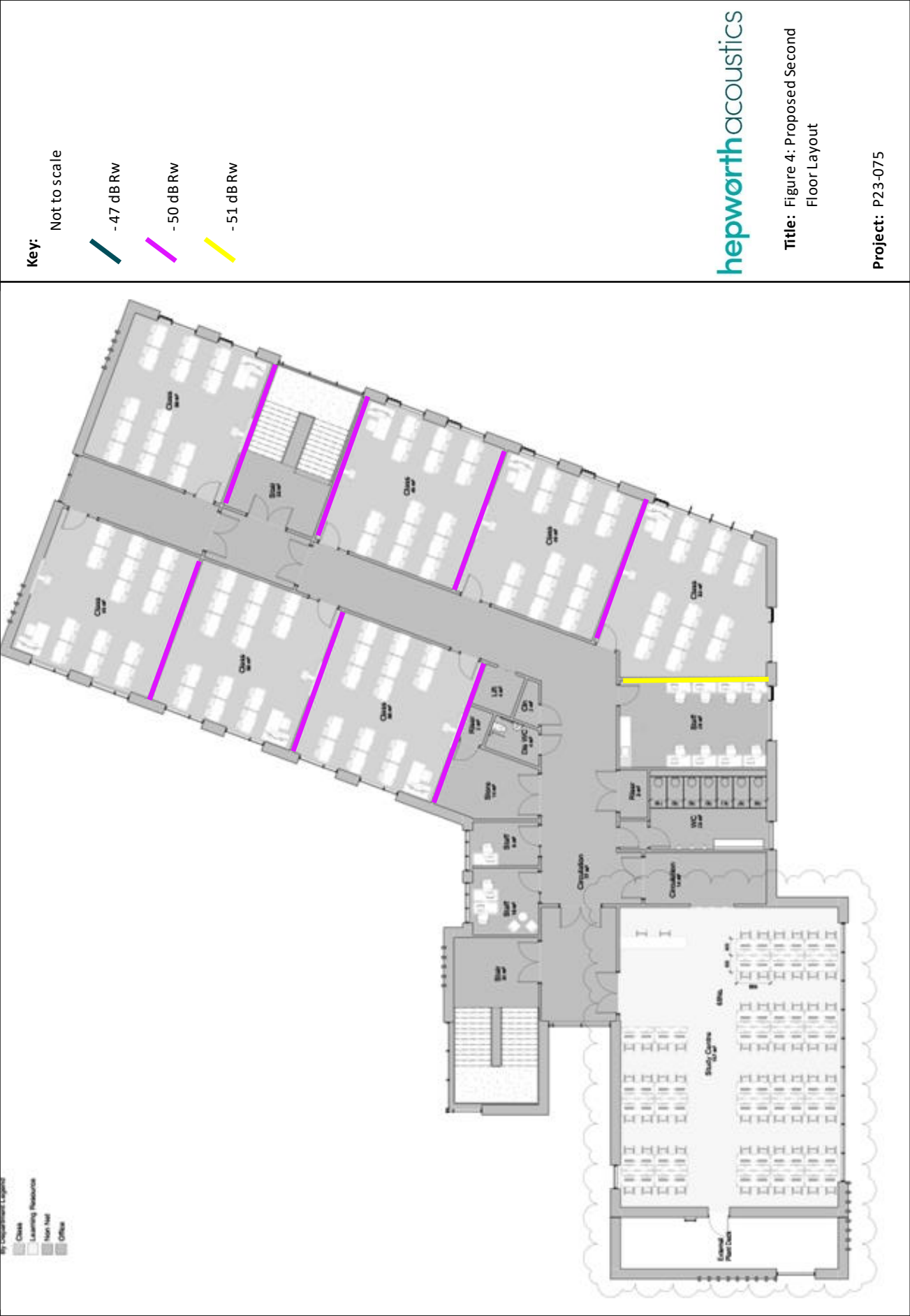
6.0 SUMMARY

- 6.1 Hepworth Acoustics Ltd was commissioned by '10architects', on behalf of Loreto Sixth Form College, to provide a RIBA Stage 3 noise assessment in support of the design process for proposed new classroom block at their college campus off Chichester Road South, Manchester.
- 6.2 Suitable acoustic design criteria have been provided in line with BB93 requirements.
- 6.3 We have provided advice on achieving the BB93 performance requirements based on the details available at this stage for the following aspects of the design:
- Upper internal ambient noise levels, due to noise break-in;
 - Airborne (walls and floors) and impact (floors) sound insulation within the building;
 - Reverberation time within relevant spaces;
 - Upper limits for building services/plant noise; and,
 - Initial comments on control of rain noise.
- 6.4 It is considered that the proposed wall and floor constructions will not meet the requirements for sound insulation performance between internal spaces. This may require a redesign of the proposed construction approach.
- 6.5 Further detailed advice regarding acoustic detailing, flanking sound transmission and rain noise will be provided as part of our Stage 4 design review, based on more detailed proposals.









Appendix I: Noise Units & Indices

Sound and the decibel

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 120dB (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.

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 dBA.

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 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, 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 can be used. The indices used in this report are described below.

$L_{Aeq,T}$ This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, $L_{Aeq,T}$ is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_I This is the 'Sound Intensity Level' which is a logarithmic ratio between a sound intensity quantity and the human threshold of hearing.

L_{IA} This is the A-weighted 'Sound Intensity Level', which is the Sound Intensity Level (L_I) adjusted to account for the average human hearing response at difference frequencies for a given sound intensity range.

$L_{Aeq,T}$ This is the A-weighted 'Equivalent Continuous Sound Level' which is an average of the total sound pressure measured over a specified time period. In other words, $L_{Aeq,T}$ is the level of a steady sound which has the same total (A-weighted) sound pressure as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for most forms of environmental noise.

$L_{A1,T}$ This is the A-weighted noise level exceeded for 1% of the time period. L_{A1} is usually used as a measure of peak noise in the assessment of noise break-in in BB93.

D_n This is the 'Normalised Level Difference' and is a field measurement of the airborne sound level difference between adjacent spaces. As well as being a field measurement, this term

and other D_n terms below include on-site conditions other than direct noise transmission through the separating partition (e.g. a wall), which is known as flanking sound transmission.

D_{nT} This is the 'Standardised Level Difference', which is equivalent to the measured D_n but corrected to a standardised reverberation time of 0.5s.

$D_{nT,w}$ This the 'Weighted Standardised Level Difference', is a frequency weighted single figure value of D_{nT} , and is the field measurement of airborne sound level difference between two adjacent spaces.

$D_{n,e}$ This the 'Element Normalised Level Difference', which is a value quantifying the sound insulation performance of a building element, such as an air vent, in a stated frequency band.

$D_{n,e,w}$ This the 'Weighted Element Normalised Level Difference', which is a single figure value quantifying the sound insulation performance of a building element, such as an air vent.

$D_{n,f,w}$ This is the 'Weighted Normalised Flanking Level Difference', which is a single figure laboratory value which is a measure of the flanking sound transmission through a building element.

R This is the 'Sound Reduction Index' as measured in a laboratory, which is a measure of the sound insulation properties of a building element (e.g. a wall) in a stated frequency band.

R_w This is the 'Weighted Sound Reduction Index' (R_w), which is a single figure quantity of R , the laboratory measured Sound Reduction Index.

$L'_{nT,w}$ This is the 'Weighted Standardised Impact Sound Pressure Level', which is a single figure value used to quantify the impact sound insulation performance of a floor tested in-situ on site.

$L_{n,w}$ This is the 'Weighted Normalised Impact Sound Pressure Level', which is a single figure value used to quantify the impact sound insulation performance of a floor tested in a laboratory.

$\Delta L_{n,w}$ This is the 'Improvement in Weighted Normalised Impact Sound Pressure Level', which is a laboratory value for the improvement in the impact sound insulation provided by a floor treatment, e.g. a soft floor covering. It is the difference between the Weighted Normalised Impact Sound Pressure Level (laboratory value) measured with and without the floor treatment. Also denoted ΔL_w in some standards, including ratings to BS EN ISO 717-2:1996.

- C_{tr} This is a weighted transport noise spectrum, which can be added to $D_{nT,w}$ or R_w in some standards to account for the spectral composition of different sound sources.
- NR Each 'Noise Rating' (NR) level (e.g. NR20, NR35 etc.) has a different value at each 1/3 octave or whole octave band; the value at each band defines the limit which a noise level cannot exceed in order for the level to fall within the NR level.
- RT/ T_n The 'Reverberation Time' is the time it takes in seconds for a sound level, typically within an enclosed space, to reduce by 60 dB (T_{60}) after the source of the sound has ceased. However, reverberation time is often measured based on the time it takes for the sound level to decrease by 20 dB (T_{20}) or 30 dB (T_{30}).
- α 'Absorption Coefficients' are the fraction of sound energy absorbed by a material. Expressed as a value between 1 for total absorption (i.e. no reflection) and 0 for no absorption (i.e. total reflection) of an incident sound wave. The absorption coefficient varies with frequency and angle of incidence.