LEIGHTON PARK SCHOOL
READING

Sound Insulation and Ventilation Schemes **Feb 2007**

Contents

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1	Sound Insulation and Ventilation Schemes	Zé Nunes	12/02/07

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1.0 Introduction

This report is the first report provided by MACH Acoustics, relating to Leighton Park School, Reading.

The purpose of this report is to provide some initial concepts and schemes relating to the sound insulation between spaces and natural ventilation to music spaces.

The purpose of this report is to provide guidance and aims to promote a creative approach. It is important to note that only concepts are provided and therefore proposed designs within this report will potentially require further investigation.

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2.0 Sound Insulation

Appendix A provides BB93 statutory sound insulation levels between teaching spaces. Note that the levels within Appendix A are rated as $D_{nT(Tmf,max)}$ levels, which indicate the on site sound insulation levels for partitions within this development. The $D_{nT(Tmf,max)}$ levels must firstly be converted to lab tested levels, R_w, such to determine the acoustic performance of partition types.

The process of converting between $D_{nT(Tmf,max)}$ and R_w values is relatively complex and involves knowing room finishes, room sizes and partition areas. At this stage, these values are as yet unknown and therefore a correction factor of +7 to +10 dB is recommended.

In simple terms, to determine the R_w requirements for the partitions shown in Appendix A, 7 to 10 dB should be added to the highlighted partitions.

2.1 Partition Types

Appendix B provides R_w levels for a wide range of partition types. Note, the value provided for composite partitions are based upon the results of INSUL modelling.

2.2 The Ground Slab

The highest specified sound insulation level shown in Appendix A is 60 dB $D_{nT(Tmf,max)}$ between the two group rooms. Based upon a preliminary calculation to BS12354 'Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 1: Airborne sound insulation between rooms', it can be shown that a solid TBA mm concrete slab (2400kg/m^3) will prevent the flanking path via the floor slab.

As a simple design concept, it will therefore be possible to use a TBA mm slab throughout this development to prevent flanking between all rooms.

The alternative to using this slab, would be to create independent slabs within sensitive spaces.

A second alternative would be use a cast in-situ slab, with varying thickness, depending upon the spaces situated above the slab. A change in the slab thickness could potentially be achieved by varying the levels of thermal insulation under the floor slab, prior to pouring the concrete. The advantage of this make up is a reduction in the quantity of concrete in the building and hence a more ecological design. If this option was to be taken forwards, MACH Acoustics would be happy to undertake further calculations.

2.3 Glazing between Music Spaces

The figure overleaf provides a glazing detail, known to achieve 52 dB R_W. The glazing used within this construction is 12.8/200/8mm glass. Note, MACH Acoustics is researching details to achieving higher levels of sound insulation, although it is very unlikely that more than 55 dB R_W will be achieved across a glazed element.

In the case where glazing is to be used in within a separating partition, the performance of this partition should be rated to achieve at least 67 dB R_W. The size of the glazed element should also be kept to a minimum. The likely performance of this partition in combination with this glazing detail, is not likely to exceed 55 dB $D_{nT(Tmf,max)}$. Note that the exact performance of the selected partition will be a function of the partition area, room volume and other factors.

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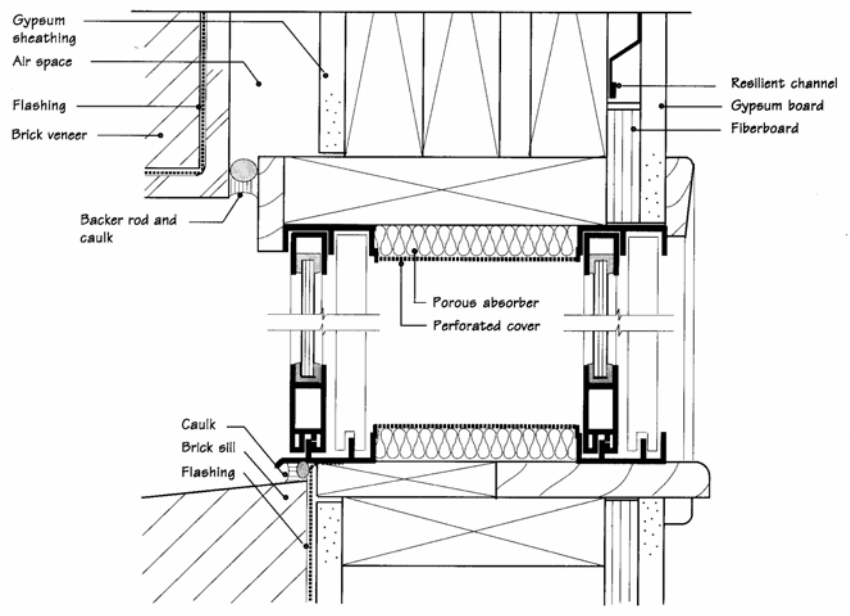


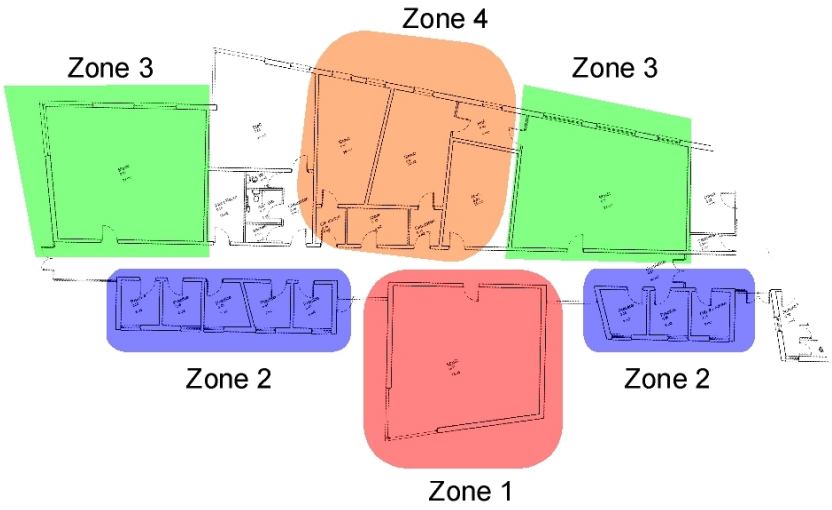
Glazing detail achieving 52 dB R_W

2.4 Sound Insulation to Corridors

BB93 requirements to all walls adjacent to circulation spaces, will be require to achieve 45 dB R_W. In addition, doors to all teaching spaces will require to achieve at least 35 dB R_W. See Appendices B and C for further details.

2.5 Sound Insulation Strategy

For the purposes of assessment, MACH Acoustics has split the building into four separate zones, where the sound insulation of each zone is addressed separately below.



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1) Large Music Room - Zone 1

This is a stand alone room and therefore it would appear that there are no specific sound insulation requirements to this space. The only required sound insulation issues to this room are those to circulation spaces, see Appendix C for further details.

2) Practice Rooms – Zone 2

At this stage, the proposed wall construction between music practice rooms is provided below.

Stud Work

Partition 2 x 15mm wall board on two 92mm Gypframe C studs at 600mm centres, Gypframe Acoustic braces, 100mm insulation achieving R_w 67 system reference A326011. Note that this construction is preferred due to buildability issues.

Or

2 x 12.5mm SoundBloc on a 70mm stud and RBI resilient bar at 600mm centres, 50mm insulation achieving R_w 62 dB system reference A316012.

Blockwork and Stud

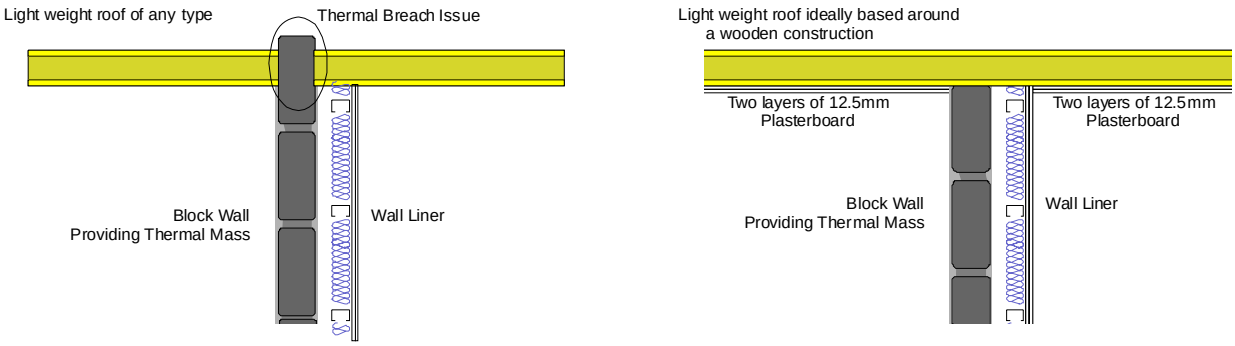
100mm lightweight block (120kg/m^2), plaster on both sides, 2 layers of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void achieving R_W 66 dB.

Flanking Details - Practice Room

If a solid or block wall where to be used, the details below are proposed to prevent flanking between music practice rooms.

Along with these details, other details are provided for light weight roofs and at the façade of the building.

Note that these details and concepts can be used in other parts of this development.



Roof detail – Block work

Note, the block wall within the above, right hand side detail, could be replaced with a stud wall.

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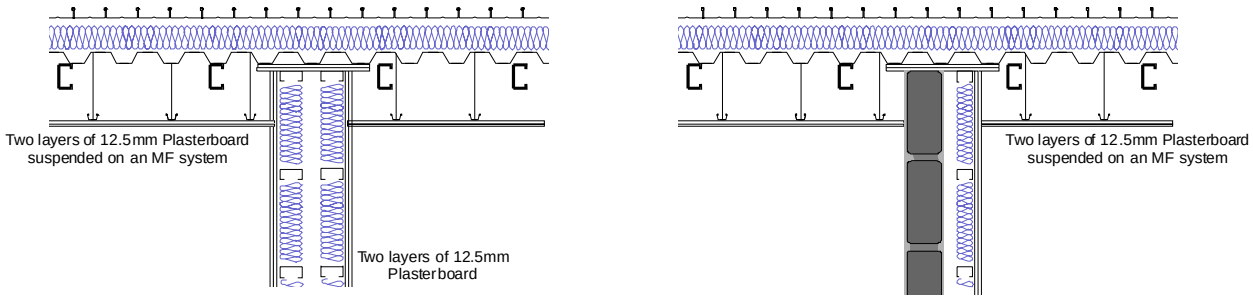
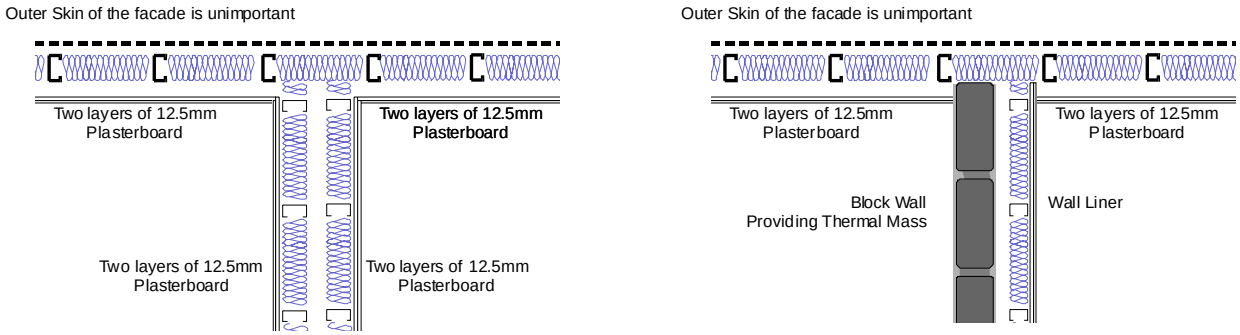


Facade detail – Light weight metal roof

Note, preventing flanking at the interface point between the separating wall and the underside of the metal deck, can be difficult and fiddly. As a result of this issue, this type of roof is not recommended. On the other hand, it is possible to seal this type of roof. Consideration should be given to the direction of the wall and the direction of the ceiling. Ideally, both the partition and the ceiling should run together.



Facade detail – Stud and block work

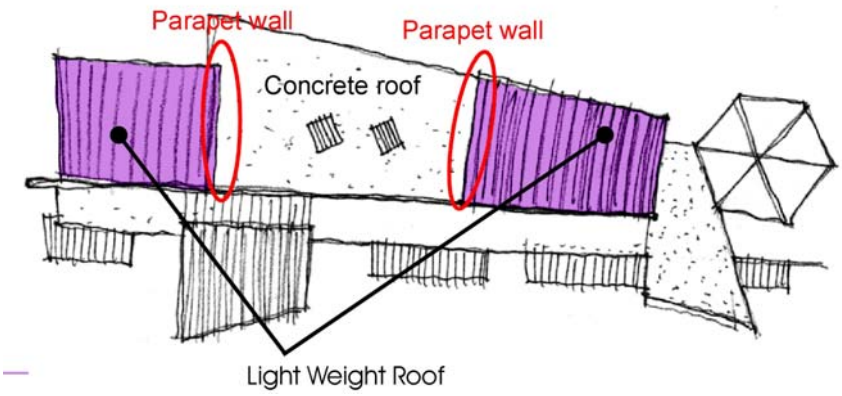
3 Large Music Rooms – Zone 3

Partitions Selection

The selection of partitions to form the music spaces can be taken from Appendix B. Alternatively, the same construction between the music practice rooms could be used.

Flanking via the Roofs

The proposed combination of light weight roofs and the solid concrete roofs to the rear half of this development, along with an offset in roof height, will provide benefits in reducing flanking between the large music practice rooms and the adjacent spaces.



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Flanking at the Facade

Some care will be required at the façade to prevent flanking. Details relating to this issue will be provided at a later stage, although the details above could be adapted to this section of the development.

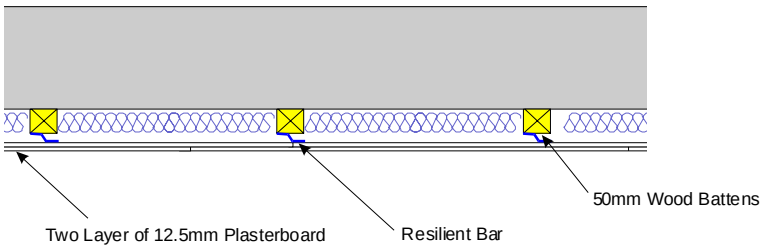
4) High Performance Music Spaces – Zone 4

Partitions Selection

At this stage, it is advised that the partitions between the two group rooms achieve at least 67 dB R_W, see Appendix C for further details

Flanking via the Concrete Roof

Over this zone, a flat concrete sofit is proposed. To prevent flanking across walls, either an MF ceiling should be used in this zone or alternatively the detail below could be used. At this stage, the thickness of the concrete needs further assessment.



Flanking at the Facade

Again, care will be required to prevent flanking via the façade. One option considered would be to place a full height vent or window at the interface between two group rooms. Note, this full height break would only be required in one of the group rooms.

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3.0 Ventilation Strategy

Two factors which will drive the level of attenuation required within the façade of this building are;

a) BB93 requires of 35 dB(A) within the music classrooms, music practice rooms and the control room and 30 dB(A) to the two group rooms.

b) A requirement for low background noise levels during recordings taking place within the group rooms and potentially within a large music classroom.

BB93

At this stage, it is assumed that 35 dB(A) can just be achieved within the practice room, music classrooms and the control room by means of conventional open windows. It is important to note that this statement is made without undertaking a noise survey. MACH Acoustics will therefore clarify the need of attenuation within the façade to music classrooms, music practice rooms and the control room, post a noise survey.

The group rooms on the other hand, are highly likely to require some form of attenuation to comply with BB93 requirements.

Music Recordings

BB93 does not consider activity noise from the school. On the other hand, when making a recording it is important to consider this type of noise, since it has the potential to disrupt a recording. It is therefore advised at this stage that some form of acoustic protection is added to air vents feeding one of the large music rooms and the two group room, to prevent activity noise break-in levels.

3.1 Cross Talk between Rooms

On of the factors affecting the design of the ventilation schemes, will be cross talk between rooms. At this stage, the exact layout of rooms and services are not known. As such, this assessment remains outstanding.

3.2 The Building Layout

The diagram below presents some alternative building layouts which could be used to reduce activity noise break-in into sensitive spaces. The first diagram presents the noise sources considered during this assessment. The principle changes in design are based upon placing noise sensitive spaces away from the activity noise sources and the music practice rooms within the adjacent building.

Diagram Illustrating Noise Sources

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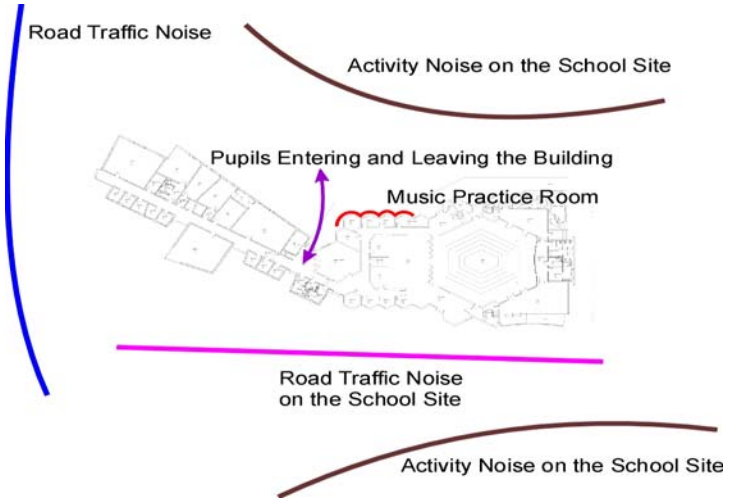
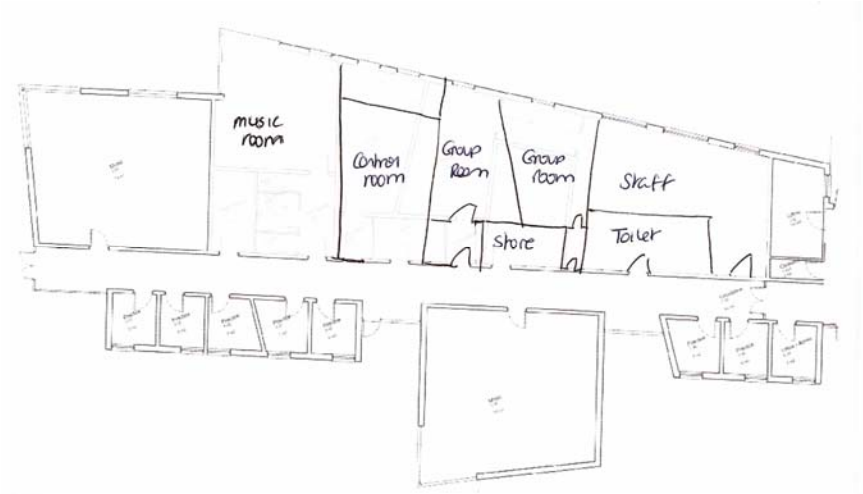
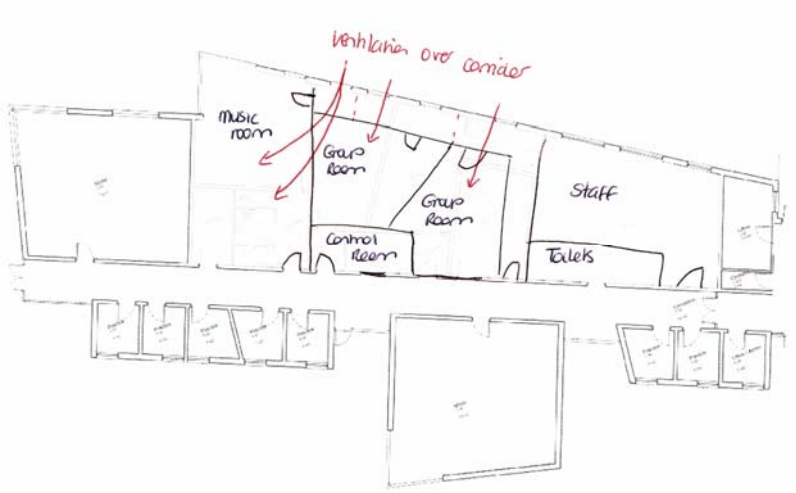


Three alternative layouts





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3.2 Ventilation strategy

To determine the exact façade requirements, a noise survey is required. Below and over leaf are some sketches which could be used to provide a degree of attenuation to the façade. Note that it is possible to combine different schemes and layouts.

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1) A parapet wall running the length of the building to provide screening to air vents.

2) Attenuator placed under solar shading. Alternatively, a bulkhead ~~shielded~~ can be used within classrooms.

3) As above, in this case, the attenuator is hidden within an earth mound.

4) Air only via a line pipe buried in the ground.

5) Parapet wall used to provide acoustic screening to air vent.

6) As above, but in extract mode

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7) Attenuator / duct placed against the spine wall.

8) Lined ducts bring air into music rooms
This option could be used to illustrate to students how the building is ventilated.

9) Acoustic labyrinth placed within Building envelope.

10) Acoustic plenum above corridor or store room.

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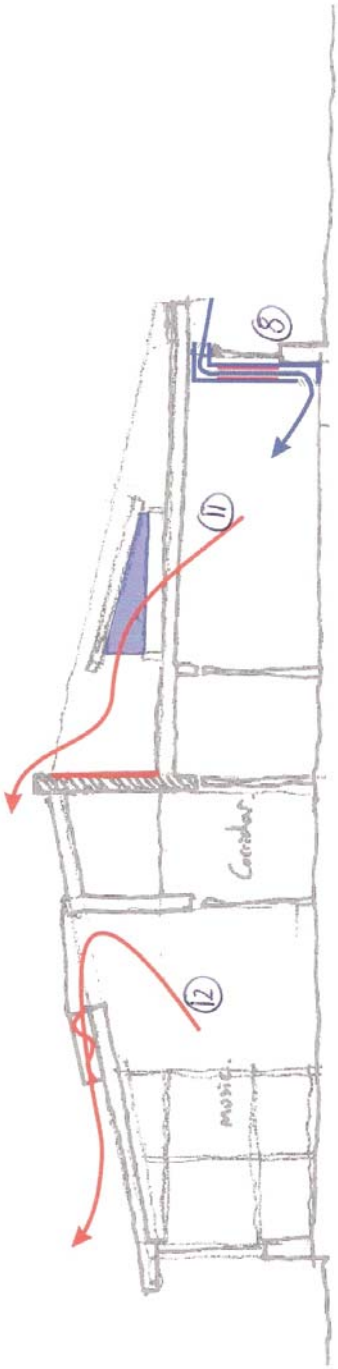

11) Air vent facing away from noise source. The blue triangle indicates an acoustic screen. The spine wall is required to be made acoustically absorbent.

12) Attenuator incorporated into roof light

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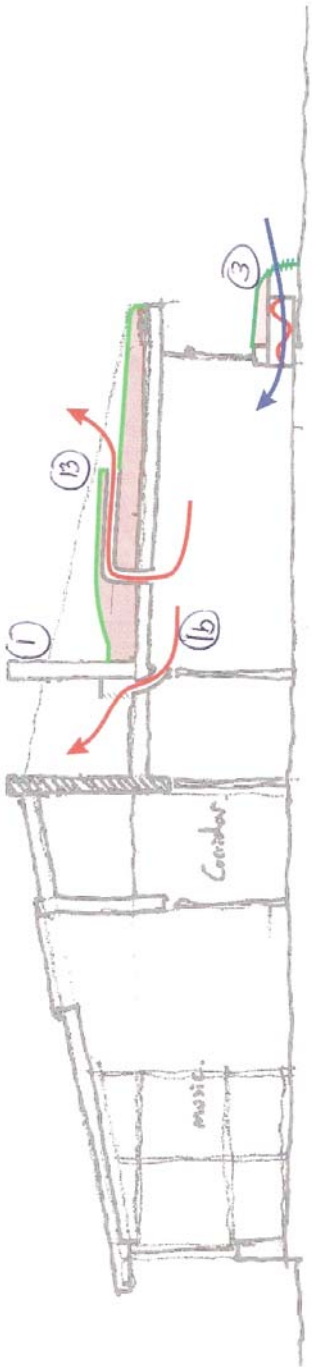

1b) As per option 1, a parapet wall is used provide acoustic screening to air vents.

13) Acoustic Duct located within grass roof.

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Appendix A - Sound Insulation Requirement for the Proposed Music Block

Diagram to be added

All walls within this development are required to achieve 55 dB $D_{nT(Tmf,max)}$ other than,

Those to corridors, required to achieve 45 dB R_W

Those between the two group room 60 dB $D_{nT(Tmf,max)}$

The partition to the large classroom, no specification

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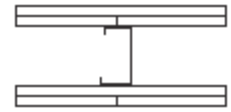
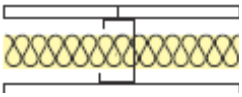
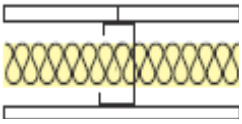
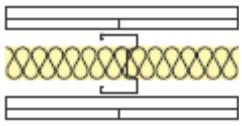
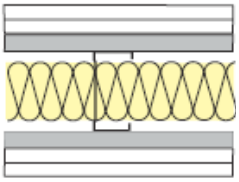
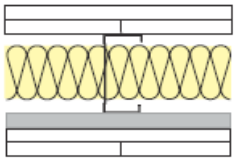
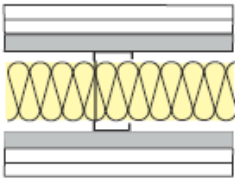
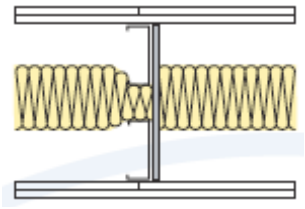
Appendix B – Sound Insulation Levels for a Range of Partitions

Wall to corridors

2	46 dB R_W		Two layers of 12.5mm SoundBloc each side of a 70mm Gypframe 'C' stud at 600mm centres.
2	47 dB R_W		One layer of 15mm Soundbloc on each side of 70mm Gypframe 'C' Stud at 600mm centres. 25mm Isowool APR 1200 in the cavity.
2	47 dB R_W		One layer of 12.5mm Soundbloc on each side of 70mm Gypframe 'C' Stud at 600mm centres. 50mm Isowool APR 1200 in the cavity.
2	46 dB R_W	Blockwork	100mm Lightweight Blockwork plaster on both sides

Wall Type	R_W Rating	Illustration	Description
5	61 dB R_W		Two layers of 15mm SoundBloc on each side of 146mm Gypframe 146 AS 50 AcouStuds at 600mm centres. 50mm Isowool APR 1200
5	62 dB R_W		Two layers of 12.5mm SoundBloc Gypframe 'C' 70mm Studs at 600mm centres with Gypframe RB1 Resilient bar at 600mm centres to both sides. 50mm Isowool
5	61 dB R_W		Two layers of 12.5mm SoundBloc Gypframe 'C' 70mm Studs at 600mm centres with Gypframe RB1 Resilient bar at 600mm centres to one side. 50mm Isowool
5		Blockwork	Blockwork not advised

6	65		Two layers of 15mm SoundBloc Gypframe 'C' 70mm Studs at 600mm centres with Gypframe RB1 Resilient bar at 600mm centres to both sides. 50mm Isowool
6	67		Two layers of 12.5mm SoundBloc on two frames of 92mm Gypframe 'C' Studs spaced at 600mm centres with Gypframe 99 FC 50 Fixing Channel at 3600mm centres or Gypframe Acoustic braces at 2400mm centres. Over all thickness 300m
6		Blockwork	Blockwork not advised

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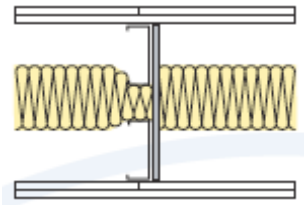
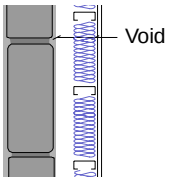
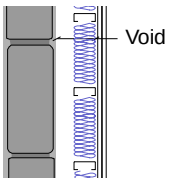
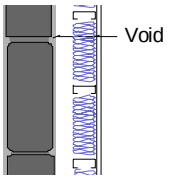
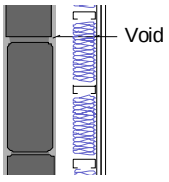
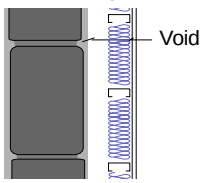
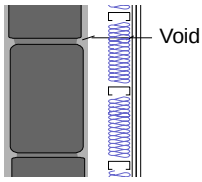
Composite walls

7	70		19mm plank and a12.5mm SoundBloc on two frames of 92mm Gypframe 'C' studs spaced at 600mm centres with Gypframe 99 FC 50 Fixing Channel at 3600mm centres or Gypframe Acoustic Braces at 2400mm centres. Over all thickness 300m
7		Blockwork	Blockwork not advised

8	R_w 60 dB		100mm lightweight block (120kg/m^2), Plaster on both side, 1 layer of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void achieving Note that the block in this case can be used to provide thermal cooling on side only.
8	R_w 66 dB		100mm lightweight block (120kg/m^2), Plaster on both side, 2 layer of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void Note that the block in this case can be used to provide thermal cooling on side only.
8	R_w 64 dB		100mm dense block (220kg/m^2), Plaster on both side, 1 layer of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void. Note that the block in this case can be used to provide thermal cooling on side only.
8	R_w 70 dB		100mm dense block (220kg/m^2), Plaster on both side, 2 layer of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void. Note that the block in this case can be used to provide thermal cooling on side only.
8	R_w 69 dB		140mm dense block (kg/m^2), Plaster on both side, 1 layer of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void. Note that the block in this case can be used to provide thermal cooling on side only.
8	R_w 75 dB		140mm dense block (kg/m^2), Plaster on both side, 2 layer of 12.5mm wall board on a 55mm independent stud, forming an air void of 75mm, 50mm of insulation in the void. Note that the block in this case can be used to provide thermal cooling on side only.

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Appendix C – Sound Insulation to Circulation Spaces

TBA

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