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Hempland Primary School

ISG Construction

Stage 3 - Acoustic Design Report

HPS-SOL-XX-XX-RP-O-0001

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HEMPLAND PRIMARY SCHOOL
STAGE 3 - ACOUSTIC DESIGN REPORT
HPS-SOL-XX-XX-RP-O-0001

SUMMARY

Sol Acoustics Ltd has been commissioned by ISG Construction to undertake an acoustic design assessment of the proposed replacement Hempland Primary School, Heworth, York.

This report presents the acoustic performance criteria that Shrivenham Primary School must achieve in order to comply with Building Bulletin 93.

This report demonstrates that indoor ambient noise limits can be achieved within all noise sensitive spaces using the proposed ventilation strategy and with standard double glazing.

Acoustic performance requirements have been set for separating walls and floors within the development. Example partition constructions have been provided and a minimum surface mass for the composite floor slab is provided.

Reverberation time criteria are presented and minimum acoustic surface finish areas are provided for all spaces.

Outline advice has been provided for building services noise, and appropriate M&E plant daytime and night time environmental noise limits have been set herein, as based on the environmental noise survey undertaken in May 2023.

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1 INTRODUCTION

Sol Acoustics Ltd ("Sol") has been commissioned by ISG Construction ("ISG") to undertake an acoustic design assessment of the proposed replacement Hempland Primary School, Heworth, York.

This report provides the following:

- Sets out the recommended acoustic performance design standards that are to be achieved within the Development
- Provides recommendations for the acoustic performance to be achieved by the external building fabric including ventilation openings
- Provides recommendations for the construction for all internal partitions and other internal separating elements
- Provides recommendations for the use of sound absorbent finishes in order to control reverberant noise and to ensure clear communication of speech between occupants
- Sets out the acoustic performance standards to be achieved by the mechanical and electrical building services both within the development and at external off-site noise sensitive receptors

The recommendations within this report have been based upon the acoustic design standards as set out in Building Bulletin 93: Acoustic Design of Schools: Performance Standards issued by the Department for Education ("DfE") in February 2015, as well as the guidance document *Acoustics of Schools: a design guide* as published jointly by the Institute of Acoustics ("IoA") and the Association of Noise Consultants ("ANC") in November 2015.

2 ACOUSTIC DESIGN CRITERIA

The acoustic design of the proposed new-build Hempland Primary School must satisfy the mandatory requirements of Approved Document E of the Building Regulations 2010: *Resistance to the Passage of Sound* ("ADE"), the School Premises Regulations 2012 and the Independent School Standards 2013.

Requirement E4 of the Building Regulations specifically applies to school buildings and states that:

> '…*Each* room *or other space in a school building shall be constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use… In the Secretary of State's view the normal way of Satisfying E4 will be to meet the values of sound insulation, reverberation time and internal ambient noise which are given in Building Bulletin 93*…'

The School Premises Regulations and Independent School Standards applies to both new and existing school buildings and contain a similar statement to that in Requirement E4 of the Building Regulations:

> '…*The acoustic conditions and sound insulation of each room or other space must be suitable, having regard to the nature of the activities which normally take place therein*...'

The performance standards as set out in in Building Bulletin 93: *Acoustic Design of Schools: Performance Standards* provide the normal means of compliance with Requirement E4 of Part E of the Building Regulations, the School Premises Regulations and the Independent Schools Standards.

2.1 Building Bulletin 93

Building Bulletin 93 ("BB93") issued by the Department for Education ("DfE") in February 2015, sets out acoustic performance standards to be achieved in a learning and teaching environment. It applies to both new-build and refurbished developments. Specifically, it provides design targets for the following acoustic considerations:

- Indoor ambient noise limits
- Sound insulation between internal spaces (airborne and impact sound transmission)
- Reverberation times in key spaces and sound absorption in corridors and stairwells
- Speech intelligibility within open plan spaces; and
- Indoor ambient noise levels generated during rain fall

BB93 sets out separate design standards for both "New-build" and "Refurbished" developments.

2.2 Acoustics of Schools: A Design Guide

Acoustics of Schools: *a design guide* ("AOS") as published jointly by the IoA and the ANC in November 2015, provides guidance and recommendations for the acoustic design of new and refurbished schools.

Whilst the main aim of this document is to provide generic acoustic design recommendations in order to be capable of achieving compliance with the acoustic performance standards set out in BB93, the AOS does specify appropriate acoustic design standards for areas of a school premises which are not enforced under Requirement E4 of the Building Regulations, and as such are not specified in BB93. In particular, AOS sets out appropriate guidance for suitable ambient noise levels to be achieved within outdoor teaching and recreational areas.

2.3 Alternative Performance Standards

BB93 recognises that Alternative Performance Standards ("APS") for acoustics may be appropriate in some instances. Any APS proposed should ideally be an improvement to the BB93 performance standard, but lower performances can be proposed providing that they can be justified. Usually, all proposed APS must be justified on the ground of educational, environmental or health and safety, but it may be possible to agree an APS on other grounds such as cost providing that the Building Control Officer (if applicable) and the Client understand and accept the reasons behind the change.

BB93 advises that APS should not normally be of a lower standard than those shown for refurbishment projects, or the specifically defined exceptions listed in the document (Section 1.2.3 of BB93 for example). Where the performance standard for refurbishment is proposed as an APS for a new school, a full and proper case must be made and documented to justify the decision.

2.5 Teaching Spaces Intended Specifically for Students with Special Hearing or Communication Needs

The Equality Act 2010 places a duty on all schools and local authorities to prepare and implement accessibility strategies and plans to increase over time the accessibility of schools for disabled pupils and staff. Schools and local authorities are required to provide strategies for:

- increasing the extent to which disabled pupils can participate in a school's curriculum
- improving the physical environment of schools for the purpose of increasing the extent to which disabled pupils are able to take advantage of education and the benefits, facilities and services provided
- improving the delivery to disabled pupils of information that is readily accessible to pupils who are not disabled

This could mean provision of physical aids and acoustic improvements which would benefit hearing impaired and other pupils.

General Teaching Spaces within the development have not been classified under the BB93 classification of *'Teaching Spaces intended specifically for students with special hearing and communication needs'* as this has not been requested by the client.

Instead, the SEN Resource Base and Library have been classified in line with BB93 criteria for *'Teaching Spaces intended specifically for students with special hearing and communication needs'* to provide a quiet space for private study and communication as suggested by BB93. This approach is assumed to be sufficient to meet the needs of SEN pupils within the school, however, it is recommended that this is signed off in writing by the School Client Body.

2.6 Client Liaison

We understand there are no specific alternative design requirements and have not been made aware of any Client or end user aspirations above or beyond the standards set out above.

3 DESCRIPTION OF SITE

3.1 General Overview of the Site and Surroundings

The existing Hempland Primary School is located within the quiet residential area of Heyworth to the north east of York City centre.

The nearest noise sensitive receptors to the development site are the existing residential dwellings on Whitby Avenue adjacent to the north, and existing dwellings on Applecroft Road adjacent to the east of the site.

Figure 1 overleaf shows the development in relation to the current existing surrounding area.

3.2 Development Proposals

The proposed development is a two-storey primary school which is to replace the existing school building. The school will consist of a single school building with cellular teaching spaces, two halls, and associated ancillary/office spaces. The proposed site layout is presented in Figure 2.

Figure 1: Development site (red line) in relation to its existing surroundings (Google Earth, 2023)

Figure 2: Site Location Plan showing the new proposed school building location in relation to the site wide plan

4 ENVIRONMENTAL NOISE SURVEY

4.1 Survey Methodology

In order to inform the environmental and intrusive noise intrusion assessment, a noise survey was conducted by Sol between the 15th May 2023 and the 18th May 2023. This consisted of one long term measurement position (MP1), as shown in blue on Figure 3:

Figure 3: Environmental Noise Survey measurement positions

4.2 Measured Noise Levels

4.2.1 *Baseline Environmental Measurement Results*

Table 1 provides a basic summary of the average, free field environmental noise levels measured at the fixed unattended measurement position MP1, representative of the building façade and existing noise sensitive receptors:

Measurement Location	Typical Measured Noise Level (Average L_{Aeq}, Range L_{Amax} and L_{A90})				
	Daytime		Night time		
	dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	dB $L_{Aeq,15hour}$	dB L_{Amax}	dB $L_{A90,15min}$
MP1	29 - 71	23 - 44	22 - 56	72	19 - 40

Table 1: Measured noise levels at MP1

5 ENVIRONMENTAL NOISE INTRUSION ASSESSMENT

5.1 Assessment Criteria

BB93 specifies maximum indoor ambient noise levels for all teaching and ancillary spaces. These levels are seen to be the overall noise levels, made up of the sum of building services noise, external noise break-in and any other noise sources present within the unoccupied, fully operational building.

BB93 also sets a maximum "L1" noise level of 60dB $L_{Aeq,30min}$ in teaching spaces to assess short transient noise levels associated with aircraft, railways and other similar sources. This is achieved by default for spaces with indoor ambient noise levels up to 40dB $L_{Aeq,30min}$, but requires assessment in spaces with indoor ambient noise level targets of 45dB $L_{Aeq,30min}$ or above

5.2 BB93 Relaxations

5.2.1 *Natural/Hybrid Ventilation*

Where a natural ventilation strategy is to be employed, the indoor ambient noise limits can be relaxed by 5dB $L_{Aeq,30min}$ where the "*normal condition*" (outlined in the appendix) is achieved. However, this does not apply to spaces with an indoor ambient noise limit of 45dB $L_{Aeq,30min}$ or higher. For hybrid ventilation systems, the mechanical system noise component must comply with the limits set out in Table 1 of BB93, however the overall noise limit can also be relaxed by 5dB $L_{Aeq,30min}$.

5.2.2 *Summertime/Intermittent Boost Ventilation*

BB93 also permits a further relaxation during the summertime. Summertime is defined as the hottest 200 hours in peak summertime. During summertime, natural and hybrid ventilation systems are permitted to relax indoor ambient noise limits to an upper limit of 55dB $L_{Aeq,30min}$.

5.2.2 *Mechanical Ventilation*

Mechanical ventilation systems are also permitted to relax indoor ambient noise limits by 5dB $L_{Aeq,30min}$ for the purpose of summertime / intermittent boost, under teacher control. Again, this does not apply to spaces with an indoor ambient noise limits of 45dB $L_{Aeq,30min}$ or higher.

5.3 Design Target

Within the development it is understood that there will be several SEN resource bases and a Sensory Room, which has been classified as a teaching space intended specifically for students with special hearing and communication needs, therefore the lowest BB93 indoor ambient noise level target for spaces within this development is 30dB $L_{Aeq,30min}$. With the additional natural ventilation relaxation of +5dB, that means the most onerous indoor ambient noise level requirement for this development is 35dB $L_{Aeq,30min}$.

5.4 Assessment Noise Levels

BB93 sets $L_{Aeq,30min}$ targets, therefore the survey data has been averaged into 30-minute periods, which are summarised below in Table 3. The table shows that measured noise levels were between 47 – 55 dB $L_{Aeq,30min}$.

Start	Duration	Measured Noise Level $L_{Aeq,30min}$ (dB)	
		16th May 2023	17th May 2023
09:00	00:30	55	53
09:30	00:30	51	52
10:00	00:30	-	52
10:30	00:30	53	-
11:00	00:30	19	54
11:30	00:30	51	51
12:00	00:30	51	49
12:30	00:30	50	51
13:00	00:30	48	51
13:30	00:30	48	43
14:00	00:30	53	45
14:30	00:30	47	57
15:00	00:30	-	-
15:30	00:30	53	48

Table 2: Measured $L_{Aeq,30mins}$ baseline noise levels

A worse case noise level of 55 dB $L_{Aeq,30min}$ will therefore be taken as a worst-case free-field noise level incident on the façade and used in subsequent assessments. Please note, measurements affected by on site school activities such as playtime/sports have been excluded from the dataset.

5.5 Building Envelope

5.2.1 *Proposed Ventilation Strategy*

BB93 provides the following outline guidance for determining an appropriate ventilation strategy based upon the as measured external ambient noise levels:

> '… *Where the external ambient free-field noise levels do not exceed the indoor ambient noise level requirement by more than 16dB for single sided ventilation spaces and 20dB for cross ventilated or roof ventilated spaces, the criteria for natural ventilation can usually be achieved* …'

Based on a worse case noise level of 55dB $L_{Aeq,30mins}$ and a partially open window providing 15dB attenuation in accordance with the guidance in BS 8233:2014 the proposed open window natural ventilation strategy is suitable to comply with the internal ambient noise level criteria of BB93, except for SEN teaching spaces.

However, Sol understands that the proposed ventilation strategy for the whole building is to use NVHR units to provide suitable ventilation.

5.2.2 *Proposed Ventilation Strategy – SEN Teaching Rooms*

Due to external noise ingress within these spaces, Sol recommends that the proposed ventilation strategy is to use a Gilberts Mistrale Fusion NVHR unit (or similar) as part of a hybrid ventilation strategy. The units will be capable of providing all required ventilation without the need for openable windows, but openable windows will be provided for comfort.

Sol has acoustic test data that shows the sound reduction of the proposed Gilberts units is between 36dB R_w and 43dB R_w depending on specific set up, duct lengths etc.

In order to assess suitability of the units and determine façade sound reduction requirements calculations have been undertaken based on a worst-case sound reduction of 40dB R_w.

Calculations have been undertaken using the worst-case façade noise level of 55dB $L_{Aeq,30mins}$ and show that the proposed Gilberts units will be adequate in meeting the most onerous BB93 internal ambient noise limit and no further mitigation is required.

5.2.2 *External Building Fabric*

It is understood that the external building envelope will consists of brickwork/SFS with an internal drylining on the ground floor, and a Euroclad Elite 54 with SFS and internal drylining on the upper floor. Both constructions have been reviewed and are considered suitable to allow the development to achieve the internal ambient noise level criteria of BB93.

Details of the proposed glazing are unknown at this stage and should be submitted to Sol for review at Stage 4.

5.6 External Roof

Details of the proposed roof constructions have not yet been confirmed. The roof construction will need to be designed in order to control the following acoustic considerations:

Environmental noise break-in

Impact noise from rainfall

Sound flanking transmission between internal spaces

Noise intrusion from any externally mounted building services equipment

A detailed acoustic review of the proposed roof construction will need to be undertaken following confirmation of the proposed build-up. It should be noted that lightweight roof constructions, whether prefabricated or a site-built systems, typically provide a lower sound insulation performance as compared to that typically provided by solid masonry constructions.

5.7 External Rooflights

In order to control environmental noise ingress and impact noise from rainfall, it is recommended that an allowance be included for double glazed rooflights, with outer laminated panes. A suitable specification will be provided as the design develops.

The use of an ETFE or polycarbonate rooflights should be avoided as these are typically poor acoustically with regards to the control of environmental noise break-in and rain noise.

5.8 Rain Noise

Rain noise test data for lightweight roofs under “heavy rain” conditions as defined under BS EN ISO 140-18:2006 is limited, therefore it is often appropriate to conduct calculations based on available test data for similar systems.

The proposed roof construction has not been confirmed at this stage, therefore rain noise test data for an expected similar construction has been used within the calculations:

Euroclad SF500

280mm Mineral Wool insulation

0.7mm thick structural steel deck

Table 3 presents the calculated “Heavy” Rain Noise Level, which is predicted to comply with BB93 requirements throughout the development:

Room	Internal Ambient Noise Limit (dB $L_{Aeq,30min}$)	“Heavy” Rain Noise Limit (dB $L_{Aeq,30min}$)	Calculated “Heavy” Rain Noise Level (dB $L_{Aeq,30min}$)
Classroom	35	60	**56**
Main Hall	35	60	**55**

Table 3: Calculated “Heavy” Rain Noise Levels

6 INTERNAL SOUND INSULATION

6.1 Assessment Criteria

5.2.1 *Airborne Sound Insulation Criteria*

The requirements of BB93 are in terms of the on-site sound level difference ($D_{nT,w}$). On-site airborne sound insulation criteria for floors and partitions are dependent on the activity noise in the source room and noise tolerance in the receiver room (as defined in BB93). Requirements are then selected based on the matrix presented in Table 4:

Minimum $D_{nT,w}$ (dB)		**Activity Noise in source room**			
		Low	Average	High	Very High
Noise Tolerance in receiving room	High	N/A	35	45	50
	Medium	40	45	50	55
	Low	45	50	55	55

Table 4: Airborne sound insulation criteria matrix (BB93, 2015)

5.2.2 *Impact Sound Insulation Criteria*

Impact sound insulation requirements for each type of space within the development are shown in **Appendix A**.

Please note, the requirement applies in the lower (“receiving”) room but treatment is to the build-up of the floor above (“source room”).

6.2 Separating Walls

5.2.1 *Sound Insulation Requirements*

Wall and floor constructions are rated in a laboratory test (or computer model) in terms of the ratio of sound incident verses sound transmitted by the partition (R_w).

The difference between the laboratory partition rating (R_w) and the on-site performance will depend on the area of the partition, the reverberation time in the receiver room, and sound paths other than the path directly through the partition (flanking sound paths).

Guideline partition ratings (R_w) which should achieve the on-site requirements, given good construction and control of flanking sound paths, are provided on the Acoustic Requirement drawings presented in **Appendix B**.

The minimum laboratory sound reduction index ratings, complete with example drywall constructions capable of achieving these required performance criteria are as provided in Table 5:

Acoustic Rating	**Minimum On-Site Sound Insulation Performance Requirement, dB $D_{nT,w}$**	**Minimum Recommended Laboratory Sound Insulation Performance, dB R_w**
1	-	**40**
2	-	**45**
3	35	**42**
4	40	**47**
5	45	**52**
6	50	**57**
7	55	**62**

Table 5: Airborne sound insulation performances of internal partitions

Please note that there are two performance standards stated above for each partition rating. The $D_{nT,w}$ parameter is the performance requirement and relates to the sound insulation performance to be achieved on-site.

The R_w parameter is the laboratory tested performance, as tested under ideal conditions, and is thus higher than the on-site $D_{nT,w}$ performance. This is due to several factors including penetration and junction detailing, pattressing and on-site workmanship, as well as other room factors such as physical room dimensions and the anticipated reverberation time, taking into consideration the lack of any sound absorption in some instances.

*To avoid confusion, it is the **R_w parameter only** that should be included on the specifications submitted to drywall suppliers.*

5.2.2 *Walls to Shared Corridors*

Table 6 presents the BB93 acoustic requirements for doors within separating partitions between noise sensitive spaces and shared circulation areas.

Area	Requirements		
	Wall & Glazing (dB R_w)	**Doorset (dB R_w)**	**Ventilators (dB $D_{n,e,w}$ - 10LogN[1])**
Multi-Purpose Hall	≥ 45	≥ 35	≥ 37
Teaching space specifically for students with special hearing or communication needs			
All other rooms used for teaching or learning	≥ 40	≥ 30	≥ 32

[1] If more than 1 ventilator is proposed then the required acoustic rating increases and can be calculated using the formula within the table header, where N is total number of ventilators within the partition.

Table 6: Acoustic requirements for doors/ventilators within separating partitions

5.2.2 *Doors*

Acoustic ratings for all proposed internal doorset are provided on the mark-ups presented in **Appendix B**.

Acoustic door sets are typically rated either 30dB R_w or 35dB R_w in line with the requirements of BB93. Doorsets which are not rated are not required to provide an acoustic performance.

Recommendations and considerations for the acoustic rated door sets are provided below. This is intended as guidance only for costing and CDM purposes and it is the responsibility of the nominated supplier to demonstrate compliance with the numerical acoustic specification in terms of dB R_w.

A laboratory rating of **30dB R_w** would typically be achieved by a 45mm solid-core timber door closing onto a rebated frame with full perimeter seals along the head, jambs, and threshold. The door would need to be side-hinged rather than pivoted. For double doors, meeting jambs need to be rebated and fitted with seals to meet the requirements. The door leaf would typically have a weight of at least 30kg/m^2.

A laboratory rating of **35dB R_w** would typically be achieved by a 54mm solid-core timber door closing onto a rebated frame with full perimeter seals along the head, jambs, and threshold. The door would need to be side-hinged rather than pivoted. For double doors, meeting jambs need to be rebated and fitted with seals to meet the requirements. Door leaf densities are typically around 50 to 65kg/m^2. Lighter doors with composite constructions are available from some suppliers. Vision panels of thick acoustic laminate glass can be used (e.g., 12.8mm).

5.2.2 *Interconnecting Doors*

With regard to interconnecting doors between teaching spaces BB93 states the following:

> *'Where it is essential to link a teaching space with another occupied room via an interconnecting door for operational or safety purposes, a doorset should be used with a rating of at least 35dB R_w. The surrounding wall (including any glazing) should have a composite sound insulation rating of at least 45dB R_w'*

Therefore, linking doors between classrooms should have a minimum sound insulation rating of 35dB R_w to meet the minimum BB93 standards.

6.2.4.1. Infant WC Doorsets

Infant Classrooms on the ground floor are linked by a lobbied Infant WC, it is therefore recommended that linking doors should provide a minimum sound insulation ration of 35dB R_w to meet the performance requirements of BB93. However, due to the high mass and potential force required to open these doorsets, others will need to advise the suitability of providing the recommended doorsets in this area.

This recommendation has been captured as an alternative performance standard ("APS") in Appendix C.

6.3 Separating Floors

5.2.1 *Sound Insulation Requirements*

On-site airborne sound insulation requirements for the majority of vertical adjacencies within the development is 45dB $D_{nT,w,}$ which corresponds to a recommended minimum laboratory weighted sound reduction index of 52dB R_w.

Some vertical adjacencies within the development require more onerous on-site airborne requirements, these are summarised within Table 8 below:

Source Room Type	Receiving Room Type	On-site sound insulation requirement (dB $D_{nT,w}$)	Recommended minimum sound reduction index requirement (dB R_w)
Sensory Room	Classroom	50	57

Table 8: Vertical adjacencies with more onerous on-site sound reduction requirements

The airborne sound insulation performance requirements between the ground floor Plant Room and the first floor Food Science room will need to be reviewed at Stage 4 when the plant room design is further progressed.

5.2.2 *Proposed Separating Floor Construction*

It is understood that the proposed separating floor will be constructed of a composite metal deck with an exposed soffit. The floor construction is understood to consist of:

150mm thick hollowcore precast concrete slab (assumed min. density of 1600kg/m^3)

75mm screed

In order to achieve the more onerous sound reduction requirement between the SEN Sensory Rooms and the adjacent Classrooms, one of the following options should be considered:

Provision of a plasterboard suspended ceiling consisting of a minimum of 12.5mm plasterboard (min. surface mass 8kg/m^2) with a minimum cavity depth of 100mm.

Provision of a lay-in grid ceiling tiles with a ‘high-mass’ acoustic tile such as Rockfon Blanka dB46.

In order to achieve a more onerous sound reduction requirement between the Plant Room and Food Science room it is recommended that provision for a plasterboard mass barrier ceiling is allowed for in the design.

5.2.2 *Impact Isolation*

In order to achieve impact sound reduction requirements a suitable acoustic resilient layer must be installed on the first floor to provide a weighted impact sound reduction of no less than 22dB ΔL_w.

This can comprise either a soft floor covering (such as bonded carpet), a specific resilient layer between the floor slab and any hard floor finish, or a resilient layer between the floor slab and a floated screed.

The following example products are suitable to achieve 22 dB ΔL_w, however all proposals should be submitted to Sol for approval and must be installed in accordance with manufacturer’s instructions including the use of resilient flanking strips where required:

Pliteq GenieMat FF02NP, FF03NP, FF05NP, FF06

8mm thick Regupol Type 6015

TVS Underscreed U22 8/4

6.4 Internal Junction Detailing

5.2.1 *Partition Interfaces*

A typical drywall junction detail between internal partitions required to control flanking transmission between the separating crosswall and corridor partition is presented in Figure 4.

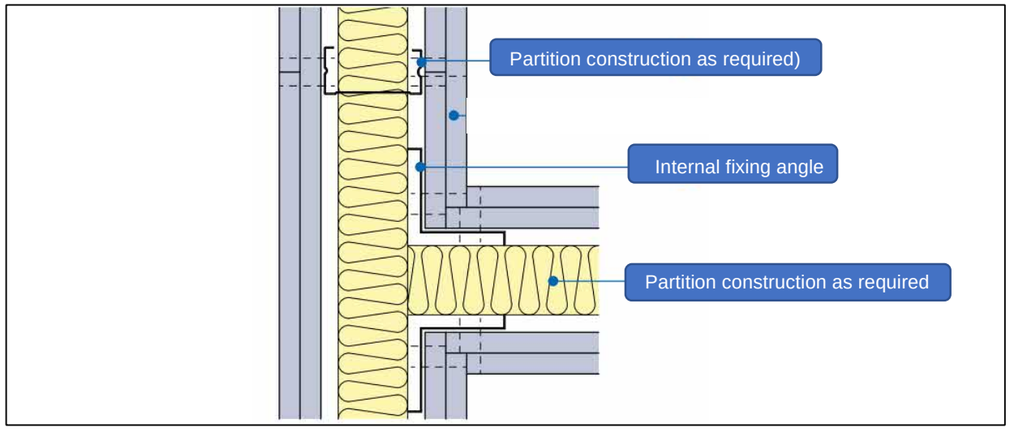

Figure 4: Recommended Interface between Internal Partitions (British Gypsum)

Please Note: All plasterboard linings, cavity linings, and stud arrangements etc. are required to reflect the manufacturer's specified wall constructions for each wall type and not necessarily that shown in Figure 4.

5.2.2 *Head Details*

In all instances, the separating partition must be constructed to be tight up to the structural soffit, sealed around any purlins and if appropriate cut into to profile of the metal deck.

Where a profiled metal deck runs parallel to a partition, troughs within the deck directly above the partition should be packed with dense unfaced mineral wool batts (minimum density 30kg/m^3).

Where a profiled metal deck runs perpendicular to a partition it is recommended that plasterboard is cut to fit the profile of the deck and sealed with acoustic mastic to ensure air tightness. Additionally, unfaced mineral wool should be placed within the two layers of board with the same specification as the separating partition construction.

Any large gaps are to first be packed with 25mm Isover APR 1200 unfaced mineral wool and then sealed with plasterboard linings to match the that of the partition construction. Small gaps <5mm can be filled with a suitable non-hardening acoustic sealant.

5.2.2 *Foot Details*

Floating screeds must not be continuous below separating partitions. Instead, the separating partition should penetrate the floating screed and meet the separating floor slab, as illustrated below.

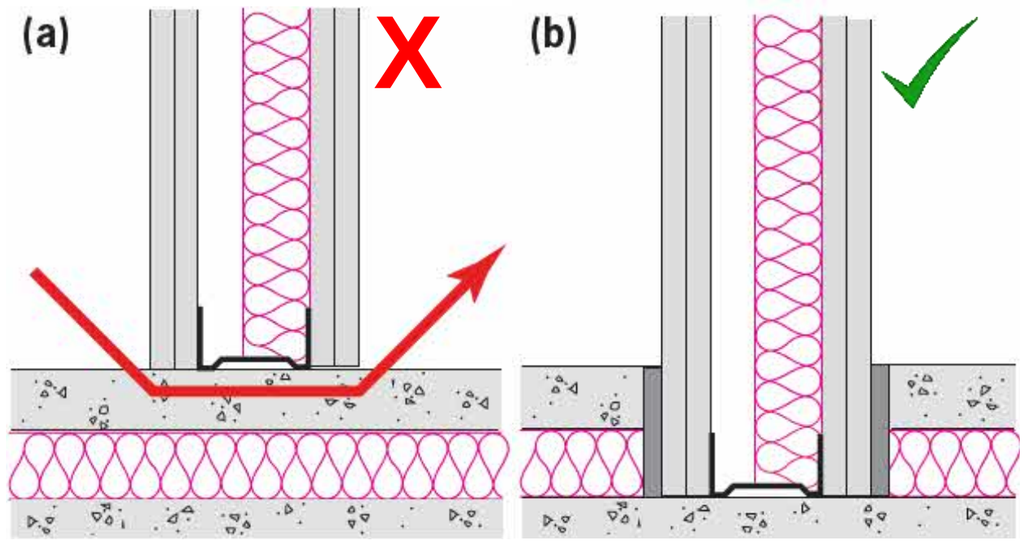

Figure 5: Recommended Foot Detail

6.5 RWP and SVP Pipework

Any RWP, SVP or SW pipework that passes through any space other than a riser must be lagged with 25mm thick unfaced mineral wool insulation and boxed in using two layers of 12.5mm thick Wallboard (or equivalent to provide a mass per unit area of at least 15 kg/m^2), taped and staggered joints and no contact between any board/framing and pipework surfaces. The enclosure must be constructed to be fully independent of the pipework.

6.6 Steel Column and Beam Encasement

A steel structural frame is proposed for the development. Continuous steelwork passing through separating partitions can carry significant risk of sound between spaces which will need to be controlled.

Where steel beams and columns are proposed to be exposed within separating partitions, an allowance should be included for encasement consisting of the equivalent number of plasterboard layers as the relevant separating partition, fixed via clips or channel (not directly fixed against the steelwork) with dense unfaced mineral wool insulation (minimum density >30kg/m^3) in the formed cavity.

Steel beams located within ceiling voids with suspended ceilings do not need to be encased.

6.7 Electrical Sockets

Recessed sockets located within separating partitions should not be mounted back-to-back, but staggered by a minimum distance of 600mm.

Acoustic putty pads must be fitted into the back-box of electrical sockets located within separating partitions in order to provide the necessary acoustic performance requirement by reducing flanking via socket outlets, enabling the wall to perform to its design intent.

6.8 Service Penetrations

Service penetrations through party wall and floor constructions can significantly reduce the acoustic performance, however the sound insulation performance can still be achieved with well detailed penetrations.

Figure 6 and Figure 7 provide standard generic penetration details for pipework and cables which can also be applied for drywall wall configurations:

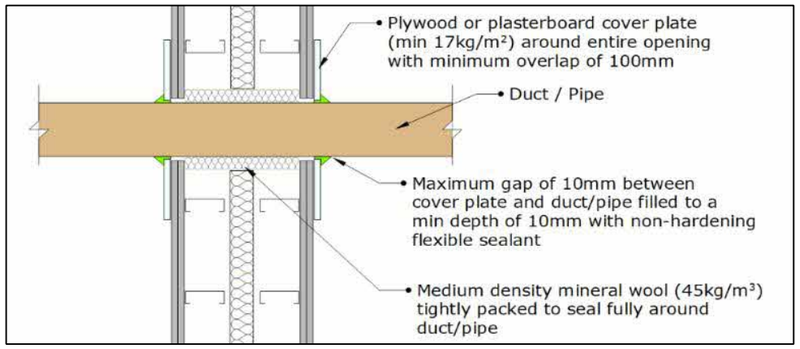

Figure 6: Example generic duct/pipe penetration detail

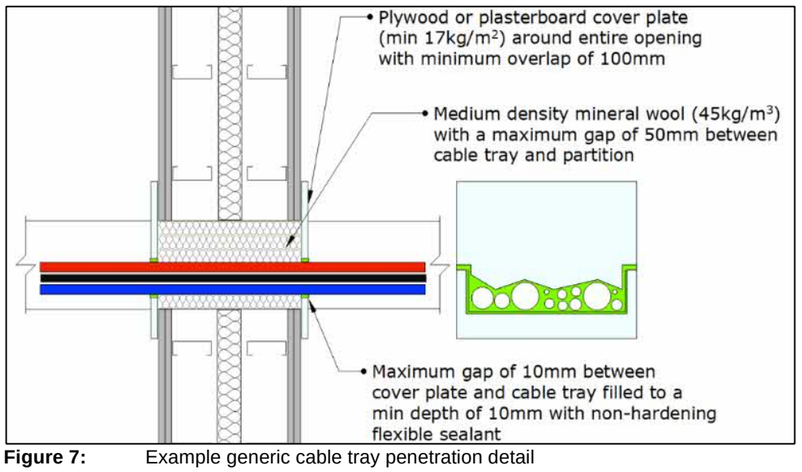

Figure 7: Example generic cable tray penetration detail

7 REVERBERATION TIME

BB93 stipulates performance standards for reverberation times to be achieved throughout the development. The criteria are specified for rooms that finished, furnished for normal use, but unoccupied, and are presented in terms of the maximum mid-frequency reverberation time (T_{mf}), the arithmetic average of the reverberation times achieved in the 500Hz, 1kHz and 2kHz octave bands.

Appendix A provides the BB93 reverberation time target for each space within the development.

7.1 Teaching Spaces

Current proposals are to use Whitecroft Foil acoustic lighting rafts within all teaching spaces throughout the development. It is assumed that a minimum of acoustic lighting 12 units will be provided to each teaching space.

Floor finishes within classrooms are a combination of vinyl and carpet, relevant areas of each floor finish have been taken into account within reverberation time calculations, which have been calculated using the Sabine formula as per BB93 guidance.

In order to achieve the BB93 reverberation time criteria, a minimum of 18m² of additional Class A wall panels will be required within all Key Stage 1 Classrooms, and a minimum of 7m² of additional Class A wall panels will be required within all Key Stage 2 Classrooms.

7.2 Sensory Rooms / Infant Group

The MI Sensory Room has been classified in line with BB93 as a '*SEN Calming Room'* and as such has a more onerous reverberation time target than standard teaching spaces (≤0.6s T_{mf}).

In order to achieve the BB93 reverberation time criteria a Class A ceiling finish should be provided within these spaces.

7.3 SEN Resource Base

The SEN Resource Base has been classified in line with BB93 as a *'Teaching space intended specifically for students with special hearing and communication needs'* and as such has a more onerous reverberation time target than standard teaching spaces (T≤0.4s average between 125-4kHz and T≤0.6s in each octave band within this range)).

In order to achieve this target, a minimum of 2m² of additional Class A wall panels will be required across the SEN Resource Base, in addition to the provision of a Class A suspended ceiling.

7.4 Food Science Room

It is unknown if the Whitecroft Foil lighting raft is suitable for use within the Food Science room due to cleaning/hygiene requirements.

In order to achieve the BB93 reverberation time criteria, a minimum of 40m^2 of Class A wall/ceiling panels will be required within this room.

7.5 Offices/Medical Rooms/Staff Rooms

In order to achieve the BB93 reverberation time criteria it is recommended that a Class A ceiling finish is provided within these spaces.

7.6 Kitchen, WCs

The control of reverberation to Kitchens and WCs is not a statutory requirement of BB93 as these spaces are not intended for teaching. However, it is recommended (but not required) that a Class D ($\alpha_w \geq 0.4$) rated sound absorbing lay-in grid ceiling finish be installed in all cases in order to be capable of meeting a recommended mid-frequency reverberation time of ≤1.5 seconds.

7.7 Corridors and Circulation Spaces

Sound absorption to circulation areas is beneficial for reducing noise transmission from traffic/activity within the circulation space to the adjoining spaces which are separated from the corridor by a single doorset, and for limiting noise transmission between adjacent spaces via the doorsets and the corridor.

There is a mandatory requirement in BB93 to provide additional sound absorption in circulation and corridor areas that give direct access to classrooms. This requirement references the method described in Section 7 of Approved Document E of the Building Regulations.

Section 7 of ADE provides two methods to determine how much additional absorption is required. Method A is to cover a specified area with an appropriate class of absorptive material. Method B is a more detailed method to calculate the required area of additional absorption based on the proposed room finishes.

ADE states the following in relation to Method A:

> *'For entrance halls, corridors or hallways, cover an area equal to or greater than the floor area, with Class C absorption or better. It will normally be convenient to cover the ceiling area with the additional absorption. Method A can generally be satisfied by the use of a proprietary acoustic ceiling. However, the absorptive material can be applied to any surface that faces into the space.'*

This requirement can be achieved with the use of a Class C ($\alpha_w \geq 0.6$) rated sound absorbent ceiling finish to all circulation areas. This requirement would apply to all proposed circulation spaces that are separated from any occupied space by a single doorset.

However, where enclosed stairwell do not provide direct access to occupied spaces, there is little merit in providing absorption to these spaces as noise breakout into occupied spaces is anticipated to be minimal. This is captured as an APS/derogation in Appendix C.

7.8 Control of Reverberation in Large, Unfurnished Spaces

In large spaces, wall absorption is required in addition to the ceiling level absorption provision. The wall absorption requirements from 'Acoustics of Schools: A Design Guide' are adequate to demonstrate compliance without the need for on-site pre-completion measurement:

> *'Sports halls, swimming pools, gymnasia, dance studios and other normally unfurnished activity spaces shall be designed to achieve a mid-frequency reverberation time (T_{mf}) given in Building Bulletin 93. Compliance with this T_{mf} criterion may be demonstrated by one of the following methods:*
>
> *1 Measurement of the T_{mf} in accordance with ANC Good Practice Guide.*
>
> *2 Use of established industry standard, commercially available software used for room acoustic prediction to form an acoustic model to predict the average T_{mf} calculated using a minimum of two source positions and six receiver positions at a height within the model of 1.5 m above finished floor level and at least 1 m from the model walls. The receiver positions should be distributed equally over the available space for making real measurements over the whole floor area, excluding the area within the minimum distance, d_{min}, from the source according to ISO 3382-2.*
>
> *3 Use of the Sabine formula to calculate both T_{mf} and the reverberation time in the 1 kHz octave band, T_{1kHz}. Neither T_{mf} nor T_{1kHz} should exceed the performance standard for T_{mf} for the particular activity space, with the following constraints upon distribution of absorption in the room:*
>
> *Requirement A: a minimum of 25% of the absorption (Sabines) in the 1 kHz octave band provided by at least Class D sound absorption distributed reasonably evenly over at least two non-opposite walls with the absorption located no higher than 75% of the room height above the finished floor level and*
>
> *Requirement B: a minimum of 30% of the absorption (Sabines) in the 1 kHz octave band provided by at least Class D sound absorption distributed evenly on the soffit and*
>
> *the remaining 45% of the required absorption in the 1 kHz octave band to be provided by finishes on any of the room surfaces.'*

Sol recommends using Method 3 set out above to demonstrate compliance with reverberation time criteria within large, unfurnished spaces. Quantities of required acoustic treatment have been calculated using Method 3 criteria.

5.2.1 *Main Halls*

The ceiling finish within the Large and Small Hall is understood to be suspended rafts, however, the exact product has not been selected. To give an indication of the number of rafts required the following product has been used in the predictions:

Product	Equivalent Absorption Area per Unit (m^2 Sabin)					
	125Hz	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**
Ecophon Solo Raft (1800x1200x40mm, 200mm suspension height)	0.70	1.80	2.70	3.10	3.20	2.90

Table 9: Example raft sound absorption

Table 10 below provides the recommended acoustic treatment to meet the reverberation time and to meet Method 3 criteria set out above.

Room	Floor Area (m^2)	Ceiling Height	BB93 Reverberation Time Target (T_{mf}, s)	Recommended Minimum Treatment	
				Minimum No. Rafts (See Table 9)	**Additional Minimum Class A Wall Finish Requirement (m^2)**
Large Hall	183	7.0m	0.8 – 1.2	35	47
Small Hall	80	7.0m	0.8 – 1.2	14	21
[1] To be distributed across walls and soffit in line with Method 3.					

Table 10: Main Halls minimum acoustic surface finish quantities

Proposed surface finishes should be submitted to Sol for review when developed.

8 INTERNAL BUILDING SERVICES NOISE

8.1 Teaching and Office Spaces Building Services Noise Limits

Appendix A provides building services noise limits for all teaching and office spaces within the development.

Building services noise limits are provided as NR ratings, and have been set using the approximate relationship of NR = dB(A) – 6 as referenced within BS 8233:2014.

8.2 Plant Room Building Services Noise Limits

Maximum building services noise limits have been calculated for Plant Room areas based on the proposed acoustic rating for separating partitions to ensure that internal noise level targets in adjacent spaces are achieved:

Source Room	Building Services Noise Limit
Plant Room	NR 65

Table 11: Plant Room Noise Limit

8.3 Cross Talk Attenuation through Ventilation Systems

If ventilation ducts link two adjacent teaching spaces, cross talk attenuators will be required. To ensure the integrity of separating structures, the passage of sound through ventilation systems is required to achieve $D_{n,e,w}$ values at least 7 dB higher than the $D_{nT,w}$ ratings provided within **Appendix B**.

8.4 Vibration Isolation

It is essential that all M&E plant (e.g. pumps, fans, adiabatic coolers etc.) are wholly and effectively vibration isolated from all building structures in accordance with CIBSE Guide B4. This requirement also extends to all substation transformers, which must also be entirely vibration isolated from all building elements and structures.

Proprietary vibration isolators must be used in all cases and these must be installed strictly in accordance with manufacturer guidelines (and must also be appropriately selected, loaded, and aligned) in all cases.

9 BUILDING SERVICES ENVIRONMENTAL NOISE IMPACT ASSESSMENT

9.1 Assessment Criteria

5.2.1 *BS 4142:2014+A1:2014*

BS 4142:2014+A1:2019: Method for rating and assessing industrial and commercial sound (“BS 4142”) is intended to be used to assess noise of an industrial nature, which includes sound from fixed installations comprising mechanical and electrical plant and equipment.

The procedure contained in BS 4142 for assessing environmental noise impact is to compare the measured or predicted noise level from the source in question, the ‘Specific Sound Level’ immediately outside the noise sensitive premises, with the corresponding ‘Background Sound Level’. Where the noise contains attention attracting characteristics such as tonal, impulsive and/or intermittent elements, it may be appropriate to apply a correction to the Specific Sound Level to obtain the ‘Rating Level’.

BS 4142 states that the significance of sound arising from an industrial and/or commercial nature depends upon both the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, and also the context in which the sound occurs:

> Typically, the greater this difference, the greater the magnitude of the impact.
>
> A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
>
> A difference of around +5dB 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.

For the daytime, the assessment is carried out over a one-hour period, and over a 15-minute period at night. The daytime and night time periods are defined as occurring between 07:00 hours to 23:00 hours, and 23:00 hours to 07:00 hours respectively.

9.2 Assessment – Off-site Noise Sensitive Receptors

Building services noise emitted by the development should be controlled not to cause a loss of amenity to nearby noise sensitive properties, i.e., Low Impact.

With reference to BS 4142, it is normal practice to limit the total, aggregate environmental noise from all M&E plant, when operating simultaneously, to an ambient noise level (in $L_{Aeq,T}$ terms) equating the typical pre-existing background noise level at any residential property façade in L_{A90} terms.

Based upon the results of the background noise survey, Table 12 provides the maximum permissible Rating Level to be achieved by the proposed M&E plant associated with the development at the nearest noise sensitive premises:

Location	Maximum permissible Rating Level, dB $L_{Ar,Tr}$	
	Daytime (07:00hrs to 23:00hrs)	Night time (23:00 – 07:00)
Any residential façade	34	28

Table 12: Plant Noise Rating Limits

The above noise level limits are specified as Rating Levels and as such it will be necessary to consider the acoustic character associated with any of the proposed M&E plant associated with the scheme when predicting the noise impact expected.

Any proposed new plant should, in the first instance, be designed to avoid having any significant tonal, impulsive or intermittent acoustic characteristics. However, where such features are expected to be present, this must be taken into consideration and suitable corrections must be applied to the predicted noise level impact when determining the predicted Rating Level from the development.

These noise level limits have been determined in accordance with the requirements of BS 4142. However, they will need to be reviewed at planning stage and are subject to the approval of the local authority.

9.3 Assessment – On-site Noise Sensitive Receptors

To control noise ingress from external plant associated with the development, where a natural ventilation is proposed it is recommended that the noise emission from plant items is limited such that the noise level at 1m from the noise sensitive room does not exceed the indoor ambient noise level for each noise sensitive room.

The above requirement is to be reviewed as the design develops. It may be acceptable to relax this requirement where alternative ventilation strategy is adopted, for example NVHRs or mechanical ventilation.

10 CONCLUSION

Sol Acoustics Ltd has been commissioned by ISG Construction to undertake an acoustic design assessment of the proposed Hempland Primary School development.

This report presents the acoustic performance criteria that Hempland Primary School must achieve in order to comply with Building Bulletin 93.

This report demonstrates that indoor ambient noise limits can be achieved within all noise sensitive spaces using the proposed ventilation strategy and with standard double glazing.

Acoustic performance requirements have been set for separating walls and floors within the development. Example partition constructions have been provided and the acoustic performance of the proposed separating floor slab has been reviewed.

Minimum acoustic surface finishing areas have been provided to meet the reverberation time requirements of BB93 in all spaces.

Outline advice has been provided for building services noise, and appropriate M&E plant daytime and night time environmental noise limits have been set herein, as based on the environmental noise survey undertaken.

APPENDIX A. ROOM CLASSIFICATIONS AND PERFORMANCE CRITERIA

Room	BB93 Classification	Indoor Ambient Noise Limit (dB $L_{Aeq,30min}$)	Services Noise Limit (dB NR)	Reverberation Limit (s T_{mf})	Impact Sound Limit (dB L'_{nTw})	Activity Noise	Noise Tolerance	To Circulation		
								Walls & Glazing (dB R_w)	Doors (dB R_w)	Ventilators (dB D_{new})
001 Infant 1	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
002 Infant Group	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
003 Infant WC	###Toilet	≤ 50	NR 44	≤ 1.5	≤ 65	Average	High	-	-	-
006 Infant 2	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
009 MI Sensory Room	SEN Calming Room	≤ 35	NR 29	≤ 0.6	≤ 60	High	Low	≥ 45	≥ 35	≥ 37
135 SEN WC	###Toilet	≤ 50	NR 44	≤ 1.5	≤ 65	Average	High	-	-	-
011 Infant 3	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
123 Infant Group	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
016 Infant WC	###Toilet	≤ 50	NR 44	≤ 1.5	≤ 65	Average	High	-	-	-
018 Infant 4	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
112 Server Room	####Plant: IT, Electrical, Gas + Water	≤ 50	NR 44	≤ 1.5	≤ 70	Average	High	≥ 40	≥ 30	≥ 32
021 Main Stair	##Corridor, Stairwell, Coats and Locker Area	≤ 45	NR 39	-	≤ 65	Average	High	-	-	-
022 Large Hall	Assembly Hall, Multi-Purpose Hall (Drama, PE, Audio/Visual Presentations, Assembly, Occasional Music)	≤ 35	NR 29	0.8 - 1.2	≤ 60	High	Low	≥ 45	≥ 35	≥ 37
116 Hall Store 1		-	-	-	-	-	-	-	-	-
115 Servery	#Kitchen	≤ 50	NR 44	≤ 1.5	≤ 65	High	High	-	-	-
023 Kitchen	#Kitchen	≤ 50	NR 44	≤ 1.5	≤ 65	High	High	-	-	-
025 Small Hall	Assembly Hall, Multi-Purpose Hall (Drama, PE, Audio/Visual Presentations, Assembly, Occasional Music)	≤ 35	NR 29	0.8 - 1.2	≤ 60	High	Low	≥ 45	≥ 35	≥ 37
136 Hall Store 2		-	-	-	-	-	-	-	-	-
119 Plant	####Plant: Mechanical	≤ 50	NR 44	≤ 1.5	≤ 70	Very High	High	≥ 40	≥ 35	≥ 32
100 Cleaner Store		-	-	-	-	-	-	-	-	-
122 Interview Room	#Office, Medical Room, Staff Room	≤ 40	NR 34	≤ 1.0	≤ 65	Low	Medium	≥ 40	≥ 30	≥ 32
046 Reception	##Corridor, Stairwell, Coats and Locker Area	≤ 45	NR 39	-	≤ 65	Average	High	-	-	-
049 Entrance Lobby	##Corridor, Stairwell, Coats and Locker Area	≤ 45	NR 39	-	≤ 65	Average	High	-	-	-
044 Admin Office	#Office, Medical Room, Staff Room	≤ 40	NR 34	≤ 1.0	≤ 65	Low	Medium	≥ 40	≥ 30	≥ 32
042 Head Office	#Office, Medical Room, Staff Room	≤ 40	NR 34	≤ 1.0	≤ 65	Low	Medium	≥ 40	≥ 30	≥ 32
041 Staff Room	#Office, Medical Room, Staff Room	≤ 40	NR 34	≤ 1.0	≤ 65	Low	Medium	≥ 40	≥ 30	≥ 32
132 Staff Work Room	Study Room (Individual Study, Withdrawal, Remedial Work, Teacher Preparation)	≤ 40	NR 34	≤ 0.8	≤ 60	Low	Medium	≥ 40	≥ 30	≥ 32
130 Staff WC	###Toilet	≤ 50	NR 44	≤ 1.5	≤ 65	Average	High	-	-	-
039 EY Lobby + WC	###Toilet	≤ 50	NR 44	≤ 1.5	≤ 65	Average	High	-	-	-
037 Hygiene Room	#Office, Medical Room, Staff Room	≤ 40	NR 34	≤ 1.0	≤ 65	Low	Medium	≥ 40	≥ 30	≥ 32
036 Reception 2	##Corridor, Stairwell, Coats and Locker Area	≤ 45	NR 39	-	≤ 65	Average	High	-	-	-
033 Reception 1	##Corridor, Stairwell, Coats and Locker Area	≤ 45	NR 39	-	≤ 65	Average	High	-	-	-
035 EY Store		-	-	-	-	-	-	-	-	-
031 EY Lobby + WC	###Toilet	≤ 50	NR 44	≤ 1.5	≤ 65	Average	High	-	-	-
029 Infant Group	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
056 Junior 5	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	NR 29	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
058 SEN Resource	Teaching space intended specifically for students with special hearing and communication needs	≤ 30	≤ 27	≤ 0.4 (average between 125-4kHz) & ≤ 0.6s in each octave band within this range	≤ 55	Average	Low	≥ 45	≥ 35	≥ 37
147 Office	#Office, Medical Room, Staff Room	≤ 40	≤ 37	≤ 1.0	≤ 65	Low	Medium	≥ 40	≥ 30	≥ 32
067 Junior 6	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
072 Junior 7	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
073 Junior 8	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
098 Junior 9	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
137 LRC	Libraries: Resource Areas	≤ 40	≤ 37	≤ 1.0	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
078 Main Stair	##Corridor, Stairwell, Coats and Locker Area	≤ 45	≤ 42	-	≤ 65	Average	High	-	-	-
095 Food Science	Electronics/Control, Textiles, Food, Graphics, Design/Resource Area, ICT Room, Art	≤ 40	≤ 37	≤ 0.8	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
090 Junior 1	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
088 SEN Resource	Teaching space intended specifically for students with special hearing and communication needs	≤ 30	≤ 27	≤ 0.4 (average between 125-4kHz) & ≤ 0.6s in each octave band within this range	≤ 55	Average	Low	≥ 45	≥ 35	≥ 37
ddd Girls WC	###Toilet	≤ 50	≤ 47	≤ 1.5	≤ 65	Average	High	-	-	-
ccc Accessible Toilet	###Toilet	≤ 50	≤ 47	≤ 1.5	≤ 65	Average	High	-	-	-
085 Junior 2	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
142 Junior 3	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32
140 Sensory Room	SEN Calming Room	≤ 35	≤ 32	≤ 0.6	≤ 60	High	Low	≥ 45	≥ 35	≥ 37
057 Junior WC Boys	###Toilet	≤ 50	≤ 47	≤ 1.5	≤ 65	Average	High	-	-	-
141 Junior 4	Primary School: Classroom, Class Base, General Teaching Area, Small Group Room	≤ 35	≤ 32	≤ 0.6	≤ 60	Average	Medium	≥ 40	≥ 30	≥ 32

Table A1: Room Classifications and Performance Criteria

APPENDIX B. SOUND INSULATION REQUIREMENT MARKUP

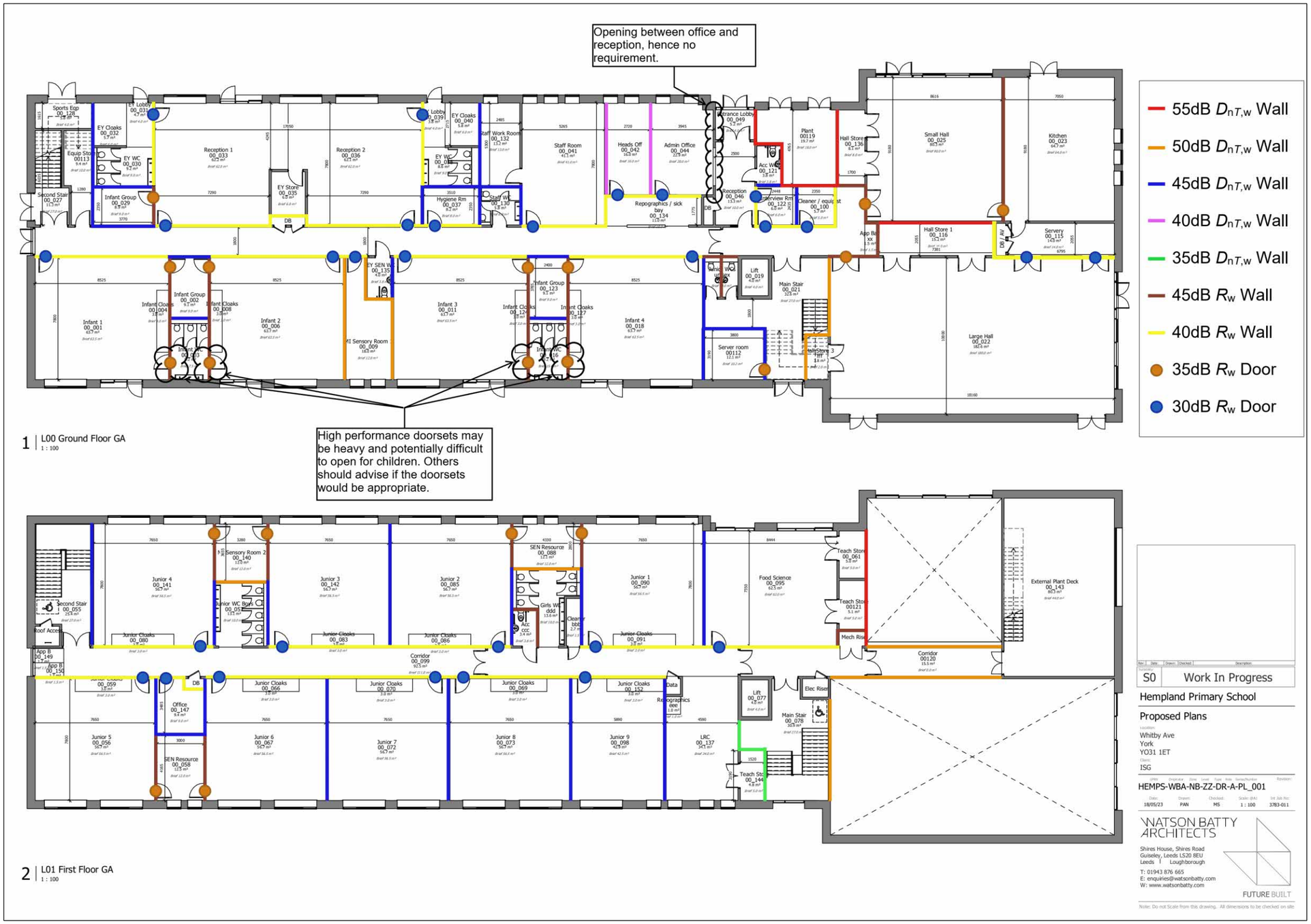

Figure B1: Sound Insulation Requirements

APPENDIX C. ALTERNATIVE PERFORMANCE STANDARDS / ACOUSTIC DEROGATION SCHEDULE

The following Alternative Performance Standards / Derogations will require sign-off by the Client, Building Control Officer and BREEAM Officer:

No.	Location and Description	Proposed APS	BB93 Design criterion	Reason for APS	Impact of APS
1	Ground floor – partitions and doorsets between classrooms and Infant WCs	45dB R_w Partition and 35dB R_w doorset	n/a	To reduce the potential for disruption to lessons as a result of noise transfer from the shared infant WCs into adjacent classrooms located either side.	The enhanced acoustic requirement will significantly increase the composite performance of the partition and it is likely that noise transfer between adjacent spaces will be minimal where the doors are closed. The enhanced requirement for the doors will mean that the doors are heavier than typical WC doors and therefore additional force may be required to open them. Others will need to advise if this is acceptable in this location given the age of occupants of the space.
2	Enclosed stairwells with no access to occupied spaces	Removal of sound absorption within the stairwells	For entrance halls, corridors or hallways, cover an area equal to or greater than the floor area, with Class C absorption or better.	Where enclosed stairwells do not provide direct access to occupied spaces, there is little merit in providing absorption to these spaces as noise breakout into occupied spaces is anticipated to be minimal.	Separating partitions between stairs and classrooms achieve c.10dB higher performance than between classrooms as corridors with direct access therefore interference with teaching is likely to be minimal.
3	Partition and doorsets between servery and large hall	40dB R_w Partition and 30dB R_w doorset	n/a	To reduce the potential for disruption to occupants of the hall as a result of noise transfer from the kitchen and servery located adjacent to the hall.	The enhanced acoustic requirement will significantly increase the composite performance of the partition and it is likely that noise transfer between adjacent spaces will be minimal where the doors are closed.

Figure C1: Alternative performance standards schedule