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21-24 Russell Square; STAGE 3 ACOUSTIC DESIGN REVIEW

CONTENTS

1.0	INTRODUCTION	2
2.0	ACOUSTIC DESIGN REQUIREMENTS	2
3.0	ENVIRONMENTAL NOISE SURVEY	7
4.0	BUILDING SERVICES DESIGN REVIEW	8
5.0	ARCHITECTURAL REVIEW	8

LIST OF ATTACHMENTS

ASI1958/SP1	Indicative Site Plan
ASI1958/TH1-TH5	Environmental noise survey data
APPENDIX A	Acoustic Terminology

Project Ref:	ASI1958	Title:	21-24 Russell Square
Report Ref:	ASI1958.210901.Stage3	Title:	Stage 3 Acoustic Design Advice
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Clarke Saunders Acoustics Winchester SO22 5BE		This report has been prepared in response to the instructions of our client. It is not intended for and should not be relied upon by any other party or for any other purpose.	

1.0 INTRODUCTION

- 1.1 The Ecole Jeannine Manuel is refurbishing the existing buildings at 21-24 Russell Square to provide additional teaching, office and ancillary school space to supplement their existing premises at 43-45 Bedford Square and 52-53 Russell Square. Proposals include the general internal refurbishment and minor remodelling of the interior layout of the existing buildings, and the addition of a new two storey extension to the rear (basement to ground floor) housing an assembly hall and dining hall/multipurpose space.
- 1.2 Clarke Saunders Acoustics (CSA) has been appointed to undertake an appraisal of the proposed acoustic design of the development in order to demonstrate that the requirements of BREEAM UK Refurbishment and Fit-out 2014 – Non-Domestic Buildings can be achieved, and the available credits awarded.
- 1.3 This report describes the acoustic design proposed in order to achieve client's design criteria and secure the three available credits available for Education buildings under the Hea05, which directly refers to Building Bulletin 93 (February 2015).
- 1.4 Please refer to Appendix A for an explanation of acoustic terminology used in this report.

2.0 ACOUSTIC DESIGN REQUIREMENTS

- 2.1 Internal and external acoustic environments will be considered in order to ensure that the internal spaces are appropriate for the intended use and that the development does not result in adverse impact on the surrounding buildings and residential receptors.
- 2.2 The project is targeting BREEAM credits for acoustics. BREEAM *Refurbishment and Fit-out 2014 – Non-domestic buildings*, two categories relate to acoustics – Hea05
- 2.3 The scheme is to be largely naturally ventilated within the main existing buildings. A hybrid ventilation scheme is proposed for the new extension areas and so a mechanical element will be involved, however, it is understood the majority of the plant is to be located internally. It is not clear whether the POL05 credit will, therefore, be available and hence this report outlines the requirements for compliance with the Hea05 credits.
- 2.4 Since the BREEAM credits for school buildings are based on compliance with the requirements outlined within Building Bulletin 93 [BB93], suitable acoustic design criteria have been set for the project on the basis of BB93 supplemented, where necessary, with other relevant standards and guidance including the Association of Noise Consultants [ANC] Good Practice Guide.

2.5 BREEAM: 2014 –HEA 05 –ACOUSTIC PERFORMANCE

- 2.6 BREEAM *Refurbishment and Fit-out 2014 –Non-domestic buildings -Technical Manual SD216 1.0-2014(Education, Healthcare, Office and Law courts)* requires the following.

Up to three credits for Education buildings

The building meets the appropriate acoustic performance standards and testing requirements defined in the checklists and tables section which defines criteria for the acoustic principles of:



- a. Sound insulation*
- b. Indoor ambient noise level*
- c. Reverberation times.*

First credit -Sound insulation Criteria

Achieve the performance standards set out in Section 1 of the Building bulletin 93: Acoustic design of schools: performance standards, February 2015¹ relating to airborne sound insulation between spaces and impact sound insulation of floors.

Testing requirement

A programme of pre-completion acoustic testing is carried out by a compliant test body in accordance with the BB93 requirements and the ANC Good Practice Guide, Acoustic testing of Schools

.Second credit -Internal indoor ambient noise levels

Criteria

Achieve the indoor ambient noise level standards set out within Section 1 of BB93 for all room types. For lightweight roofs and roof glazing calculations using laboratory data with 'heavy' rain noise excitation as defined in BS EN ISO 140-18 are required (in accordance with the guidance in BB93) for teaching/learning spaces to demonstrate that the reverberant sound pressure level in these rooms are not more than 25 dB above the appropriate limits presented within Section 1 of BB93, table 1.

Testing requirement

Indoor ambient noise levels (excluding rain noise):

A programme of acoustic measurements is carried out by a compliant test body in accordance with the ANC Good Practice Guide, Acoustic testing of Schools.

Rain noise: installation of a specification compliant with the BB93 criteria demonstrates compliance, reference is also made to the notes below.

Third credit –Reverberation Criteria

Acoustic environment (Control of reverberation, sound absorption and speech transmission index (STI)):

Teaching and study spaces: achieve the requirements relating to reverberation time for teaching and study spaces set out within table 6 in Section 1 of BB93.

Open plan teaching spaces: achieve the performance requirements relating to speech transmission index (STI) set out within Section 1.8 of BB93.

Corridor and stairwells: for those that give direct access to teaching and study spaces, achieve the performance requirements relating to sound absorption.

Testing Requirement

Teaching and study spaces:

A programme of acoustic measurements is carried out by a compliant test body in accordance with the ANC Good Practice Guide, Acoustic testing of Schools.

Open plan teaching spaces:

STI Measurements should be taken in at least one in ten typical student listening positions in the open plan spaces in accordance with the ANC Good Practice Guide, Acoustic testing of Schools.

Corridors and stairwells:

Installation of a specification compliant with the BB93 criteria demonstrates compliance. Where this refers to the use of Building Regulations, the country-specific Building Regulations or standards can be applied.

2.7 SOUND INSULATION [BB93]

- 2.7.1 BB93 specifies the minimum requirement for airborne and impact sound insulation of partitions between spaces of differing functions. The performance requirements are determined on the basis of the activity noise in one room and the sensitivity to noise of the adjacent room, therefore, taking in to account the expected functions of the adjacent spaces.
- 2.7.2 The minimum airborne sound insulation performance requirements for the spaces relevant to this development are summarised in the table below, on the basis of the scheme being categorised as “refurbishment” unless otherwise stated.
- 2.7.3 Alternative criteria are specified for teaching spaces intended specifically for students with special hearing and communication needs. We are not aware of any spaces within the development that fall within this category.

SOURCE	RECEIVE	ACTIVITY NOISE - TOLERANCE	MINIMUM PERFORMANCE
Office	Office	Low – Medium	$\geq 35 D_{n,T,w}$
Classroom-	Group Room	Average – Medium	$\geq 40 D_{n,T,w}$
Circulation	Classroom	Average – Medium	$\geq 40 D_{n,T,w}$
Circulation	Group Room (with doors)	Average – Medium	$\geq 40 R_w$
Classroom	Classroom	Average – Medium	$\geq 40 D_{n,T,w}$
Toilets	Classroom	Average – Medium	$\geq 40 D_{n,T,w}$
Classroom	Office	Average – Medium	$\geq 40 D_{n,T,w}$
Drama Studio	Assembly Hall/ Dining Hall	High – Low	$\geq 50 D_{n,T,w}^*$

Table 1 Minimum airborne sound Insulation performance requirements.

* Refurbishment criteria

2.7.4 BB93 states a minimum composite sound reduction index of R_w 40dB, where a separating element between a circulation space and a teaching area contains doors and/or glazed elements. Doorsets should achieve minimum R_w 30dB.

2.7.5 The impact sound insulation performance standards for separating floors required by BB93 are summarised in the table below.

RECEIVING ROOM	MAXIMUM IMPACT SPL $L'_{nT,w}$
Classroom	65 dB
Drama studio	
Office	
Lobby	
Corridors	
Toilets	

Table 2 Impact Sound insulation performance for separating floors

Testing Requirement

2.7.6 The sound insulation is assessed by means of on-site commissioning measurements in accordance with BS EN ISO 16283-1 and the results expressed as weighted standardised level difference, $D_{nT,w}$, in accordance with BS EN ISO 717-1. The reference reverberation time used for the calculation of the results is the measured reverberation time, provided that the mid-frequency reverberation time, T_{mf} , complies with the BB93 requirements in the finished and furnished receive room.

2.8 INTERNAL AMBIENT NOISE LEVELS (IANL) [BB93]

2.8.1 BB93 specifies suitable internal ambient noise levels for areas of differing functions when they are finished, furnished for normal use and unoccupied. The objective of these is to provide:

- Clear communication of speech between teacher and student;
- Clear communication between students;
- Learning and study activities.

2.8.2 The IANL includes contributions from external noise sources outside of the school premises and noise from building services systems. In the case of naturally ventilated rooms, the IANL should meet the criteria with ventilators and/or windows open as required to provide ventilation.

2.8.3 The IANL criteria exclude noise sources from within the school premises such as playground activity, equipment in the building and rain noise. However, rain noise is addressed separately as outlined below.

2.8.4 The criteria of internal ambient noise levels are relaxed by 5dB for naturally ventilated rooms, up to a maximum of 45dB for teaching or learning spaces.

2.8.5 The IANL upper limit design criteria for the various applicable areas to the project are summarised on the table below.

AREA	IANL $L_{Aeq,30\text{ mins}}$ MECHANICAL VENT	IANL L_{Aeq} NATURAL OR HYBRID VENTILATION
Classroom*	-	45 dB
Drama studio / Assembly Hall / Multi-purpose Hall	-	45 dB (refurb)
Office	-	50 dB
Breakout	-	50 dB
Corridor	-	60 dB
Toilets	55 dB	-

Table 3 Maximum internal noise levels for occupied areas

**summertime-ventilation under control of teacher to prevent overheating- allowable during the hottest 200hrs of the year natural or hybrid ventilation <55dB*

- 2.8.6 For the Drama Studio and Assembly Hall area served by a hybrid ventilation system, the maximum noise levels stated are a combination of mechanical system noise and external noise intrusion. Mechanical services noise must not exceed 40 dB within these areas.
- 2.8.7 In order to protect students from regular discrete noise events, indoor ambient noise levels should not exceed 60dB $L_{A1,30mins}$. This is typically aimed at control of noise sources such as aircraft or trains but may be applicable to buses in Russell Square.

2.9 REVERBERATION TIMES [BB93]

- 2.9.1 The reverberation time (RT) criteria specified in BB93 are applicable to finished, furnished and unoccupied rooms. The objective is to achieve:
- Clear communication of speech between teacher and student;
 - Clear communication between students;
 - Music teaching and performance.
- 2.9.2 The criteria are quoted in terms of mid-frequency reverberation times, T_{mf} , which is the arithmetic average of the reverberation times between 500Hz and 2kHz octave bands or between 400Hz and 2.5kHz third octave bands.
- 2.9.3 For teaching spaces used by students with special hearing or communication needs, the specified reverberation times are in terms of T_{mf} values calculated between 125Hz and 4kHz octave bands and between 100Hz to 5kHz third octave bands. We are not aware of any areas within this category in the development, where necessary these will be highlighted and address separately.



AREA	RT T _{mf} (seconds)	
	NEW	REFURBISHED
Primary Classroom & Group Rooms	≤ 0.6	≤ 0.8
Drama studio / Dance studio	≤ 1.0 / ≤ 1.2	≤ 1.0 / ≤ 1.5
Assembly Hall / Multi-purpose Hall	0.8 – 1.2	0.8 – 1.5
Library	≤ 1.0	≤ 1.2
Office	≤ 1.0	≤ 1.2
Reception	≤ 1.5	≤ 2.0

Table 4 Target reverberation times

2.9.4 Finishes within the corridor / circulation space should comply with the performance requirements in Approved Document E Resistance to the Passage of Sound (ADE) of the Building Regulations 2010.

2.9.5 There are two methods detailed in ADE 2010 to enable the control of reverberant sound within corridors:

A) By covering an area equal to or greater than the floor area with a Class C acoustic absorber (or better), rated according to BS EN ISO 11654:1997, or;

B) By ensuring that a minimum of 0.25m² of total absorption per cubic metre of the room volume is provided.

2.10 RAINFALL [BB93]

2.10.1 No absolute criteria are provided for internal sound pressure levels due to rain, however, BB93 states that the increase in noise levels during heavy rain (calculated following procedures in BS EN ISO 140-18 for 'heavy' rain) should be no more than 25dB above the appropriate internal ambient noise level for the space.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 A survey of the background noise levels was undertaken at first-floor level at the location shown on site plan AS11958/SPI. Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 17:30 hours on Wednesday 16th December and 11:00 hours on Monday 21st December 2021.

3.2 SURVEY PROCEDURE AND EQUIPMENT

3.2.1 The following equipment was used during the course of the survey:

- Rion data logging sound level meter type NA28;
- Rion sound level calibrator type NC74.

3.2.2 The calibration of the sound level meter was verified before and after use. No significant calibration drift was detected.

3.2.3 The weather during the survey was generally dry with light winds, which made the conditions suitable for the measurement of environmental noise.

3.2.4 Measurements were made following procedures in BS 7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2- Acquisition of data pertinent to land use.*

3.2.5 Please refer to Appendix A for details of the acoustic terminology used throughout this report.

3.3 RESULTS AND DISCUSSION

3.3.1 The background noise climate at the site is determined by road traffic on nearby roads and nearby plant.

3.3.2 The measured maximum noise levels are shown in the table below.

MONITORING PERIOD	MINIMUM BACKGROUND $L_{A90,5MIN}$	AVERAGE AMBIENT L_{Aeq}	TYPICAL BACKGROUND $L_{A90,5MIN}$
Daytime (07:00-23:00 hours)	44 dB	63 dB	49 dB
Night-time (23:00-07:00 hours)	40 dB	58 dB	43 dB
Class Time hours	-	-	54 dB

Table 5 Measured environmental noise data

4.0 BUILDING SERVICES DESIGN REVIEW

4.1 It is understood that all the existing building areas are to be naturally ventilated, with the exception of toilets and kitchens where extract fans will be installed.

4.2 The new build section, housing the Drama / Dance Studio and Assembly/ Dining Hall will be provided with a mix mode ventilation system.

4.3 A complete review of building services will be undertaken once further information on the selected plant and ducting has been provided.

5.0 ARCHITECTURAL REVIEW

5.1 The following sections provide a review of the proposed design and an assessment of its suitability to meet the required design criteria.

5.2 EXTERNAL BUILDING FABRIC

New Build Section

5.2.1 The noise levels incident on the façades of the new building area are typical of an urban area. Typical noise levels during the school day are L_{Aeq} 54dB.

5.2.2 BB93 indicates that provided external noise levels do not exceed the IANL criteria for a given space by more than 16dB(A) then the building is likely to be compliant. For hybrid ventilated classrooms the IANL criterion is 40dB(A) and hence the building is expected to be suitable for a natural ventilation strategy.

- 5.2.3 The current design for all non-glazed elements of the external building envelope is for a double leaf blockwork construction with mineral wool in the cavity and timber cladding on the exterior. Internally, the walls will be lined with 15mm plasterboard. Although drawings do not specify, it is assumed that this will be dot and dabbed directly to the blockwork.
- 5.2.4 The design indicates ceiling mounted mixed mode ventilation (MMV) units in both the drama studio and assembly hall, ducted to intake louvres at high level. Motorised dampers control extract louvres, also at high level in both spaces. Since the existing external noise levels in this area indicate that the building is suitable for natural ventilation, it is expected that the overall sound insulation performance of the external building fabric with a hybrid ventilation system in place will be acceptable, however, this will be reviewed at Stage 4 when full details of the building services scheme are available.
- 5.2.5 The roof is understood to comprise a 150mm concrete composite slab with vapor control later (VCL), tapered insulation and a Bauder Total Roof system on top. This construction will be assessed once further details have been provided, including the full build-up of the Bauder system. It is understood that the roof will be used as external curriculum space and as such both impact and airborne sound insulation performance will need to be considered.
- 5.2.6 On the basis of the current description, the noise due to rainfall on the new build elements is expected to be controlled to suitable levels, with regards to section 2.10.

Existing Section

- 5.2.7 At lower floors the existing glazing consists of single glazed sash windows with secondary glazing. The upper floors have only single glazed sash windows with no secondary glazing.
- 5.2.8 Internal ambient noise levels were sampled in several rooms on the first floor overlooking Russell Square on 21st December 2020. IANLs with windows closed were measured between L_{Aeq} 36 – 45dB at 1st floor level, indicating the existing glazing is generally adequate for the control of external noise to BB93 criteria, when closed. The upper end of this range was measured at 1st floor level of No. 24 in a room with no secondary glazing and can be considered representative of the upper range of noise levels likely to be experienced in rooms on the upper floors when windows are closed.
- 5.2.9 IANLs with windows open range from L_{Aeq} 48 – 54dB, which suggests noise levels could be in excess of the required internal ambient noise level criteria at times for some spaces. It is noted that the buildings are south facing and are therefore likely to be subject to solar gain during the summer months and so window are more likely to be opened for ventilation.
- 5.2.10 It is understood that new secondary glazing is proposed to be installed on all windows overlooking Russell Square, with the Selectaglaze Mid-range 25 product being the most likely selection. Current drawings indicate a frame gap of between 75 – 300mm between the primary and secondary frames with a vinyl faced acoustic foam product in the window surround, as shown in drawing 2676-EWA-ZZ-ZZ-DE-A-23114 dated 16th April 2021.

- 5.2.11 Test data for the proposed window design has not been made available and will be reviewed at the detailed design stage.

5.3 INTERNAL BUILDING FABRIC – SEPARATING WALLS

New Partitions

- 5.3.1 Mark up of proposed internal wall performances have been provided by Ellis Williams Architects, dated 15th July 2021. These have been reviewed and advice has been given in reference to the minimum performance stated in the above section 2.7.
- 5.3.2 The below build ups have been proposed by Siniat as part of their Project Pack dated 22nd July 2021:
- Wall type A – R_w 47 dB – 90mm C studs with 1no. 12.5mm GTEC standard Board & 1no. 15mm Siniat Megadeco Board on each side.
- 5.3.3 The Siniat literature does not provide laboratory test data for this construction. Comparison with similar constructions and materials from other suppliers indicates that the quoted performance specification of R_w 47 dB is likely.
- 5.3.4 EWA drawings indicate that this wall will be used for new partitions separating teaching spaces and as such should achieve a minimum of $D_{nT,w}$ 40dB on site. Generally, manufacturer guidance recommends a minimum margin of around +7dB between laboratory performance (R_w) and on site performance ($D_{nT,w}$) and as such this selection meets the minimum recommended performance. Good workmanship and attention to detail during installation of the partition on site can minimise the reduction in performance and provided this is maintained then this partition can be expected to be compliant.
- Wall type B – R_w 40 dB – 90mm C stud at 600mm centres with 1no. 15mm Siniat Megadeco Board on each side
- 5.3.5 The Siniat Drywall Manual lists this as construction type RMP 127 rated at R_w 42dB by the manufacturer.
- 5.3.6 This wall type is generally shown for partitions between classrooms and circulation spaces which have doors, therefore requiring a minimum performance of R_w 40dB. This partition is therefore considered acceptable for these uses.
- Wall Type C – R_w 40dB – 70mm C Stud with 1no.15mm Siniat Megadeco Boards on each side.
- 5.3.7 The Siniat Drywall Manual lists this as construction type RMP 001 rated at R_w 40dB by the manufacturer.
- 5.3.8 This wall type is shown in various locations, typically between ancillary areas but in some cases form parts of partitions between teaching areas and circulation spaces. In these cases a minimum design performance of R_w 40dB is required and as such this would be acceptable.
- 5.3.9 It is noted than this partition is proposed between a plant room (B.22.07) and a WC (B.22.08). The required performance of this partition is dependent on the noise emissions

from the plant and as such this will need to be reviewed with the building services information at the detailed design stage.

Internal Glazed Screens

5.3.10 A number of glazed partitions have been proposed between circulation spaces and other occupied spaces.

5.3.11 A review of a number of glazed items was provided via email on the 12th July 2021. A summary of this review is presented below:

- Screen IS.B.24.01a & 01b – Classroom -Circulation

5.3.12 Glazed element to be selected to a minimum R_w 35 dB and door with a minimum performance of R_w 30dB.

- Screen IS.G.23.08 – Assembly/Dinning Hall – Circulation

5.3.13 Where the Assembly Hall is only intended for use as an assembly/dining hall, then a minimum overall performance standard for this partition of R_w 40dB may be considered appropriate. In this case, since the glazed element constitutes the majority of the overall partition size, both drywall and glazing should be selected to achieve R_w 40dB. If R_w 40dB proves challenging to achieve for the glazing then we can advise on alternatives as required.

5.3.14 However, if this room is intended for other uses, it may be better characterised as a “multi-purpose hall”. In this case, BB93 states the following:

“Vision panels between multi-purpose halls, music rooms and control rooms require careful consideration. If visual communication only is required then the vision panel should provide at least 45 dB R_w , set within a wall rated at 55 dB R_w . This degree of sound insulation from a vision panel will require specialist design input. Where visual and audio communication is required between the spaces then a sliding vision panel of only nominal acoustic performance may be appropriate, set in a wall rated at 45 dB R_w .”

5.3.15 As noted, glazed partitions meeting the above specifications require specialist products and design input, and would require careful consideration if implemented.

- Screen IS.G.23.01 – Staff work room – Circulation

5.3.16 There is no minimum requirement from BB93 for this partition. A minimum performance of R_w 30 dB would be appropriate and both door and glazed elements should be selected to achieve this value.

- Screen IS.G.23.05 – Classroom – Circulation

5.3.17 The minimum overall performance requirement for this partition is R_w 35dB. If the drywall was selected to achieve R_w 35dB then the glazed element would need to be a minimum of approximately R_w 33dB. However, as above, a lower performance glazed element could be offset by selection of a higher performance drywall element. For example, if the drywall was selected to achieve R_w 40dB, then a R_w 30dB glazed element would still be sufficient.

- Screen IS.F.22.04 – Meeting Room – Circulation

5.3.18 Where the meeting room is for staff use, BB93 does not provide a specific performance standard for these adjacencies. An appropriate minimum performance standard can be determined based on privacy requirements. As a minimum, $D_{nT,w}35\text{dB}$ would be appropriate to offer a basic level of privacy.

5.3.19 Since the majority of the partition is glazed, the glazing (inc. frames, seals, etc) would need to be selected to achieve $R_w35\text{dB}$.

5.3.20 Typically, a good quality laminated safety glass would be expected to achieve this. If a higher level of privacy is desirable then a higher performance should be targeted.

Existing Walls

5.3.21 Pre-commencement sound insulation tests of the existing separating walls were undertaken in December 2020 and reported in full in the feasibility report dated 22nd January 2021 (ref. AS11958.210122.R1.1).

5.3.22 In general, the existing walls were shown to achieve an acoustic performance sufficient for compliance with BB93 criteria.

5.3.23 One existing partition was notably lower than the other which is shown to be retained; this is between the Head's Office (S.22.02) and the PA Office (S.22.01) which achieved $D_{nT,w}34\text{dB}$. Although compliant with the minimum performance specified by BB93, it should be noted that this offers a lower level of privacy (where a 'basic level' could be expected) between these spaces when compared to the other retained wall.

5.3.24 If a higher level of privacy is desirable, further acoustic design input would be required. It was noted during the testing that the existing doors were not well sealed and presented a significant flanking path. Improvement to the doors to these spaces, may, therefore, offer an improvement to the acoustic separation here.

5.4 INTERNAL BUILDING FABRIC – DOORS

5.4.1 Doors should be sourced from a supplier able provide traceable evidence of the components having been tested in combination and shown to achieve R_w performance values shown in Section 1.1.1. In general, doors should comprise:

- Solid core panel ($\geq 25\text{kg/m}^2$);
- Viewing panel of glazing type able to meet the overall required sound reduction;
- Good quality compression seals fitted to stops on the head and jambs of the frame;
- Automatic drop seal at the door threshold.

5.4.2 All seals should be fitted so as to provide a continuous seal around the door edge. Hinges should be set to ensure even compression of seals.

5.5 INTERNAL BUILDING FABRIC – SEPARATING FLOORS

Existing Buildings

- 5.5.1 Pre-commencement sound insulation tests of the existing separating floors were undertaken in December 2020 and reported in full in the feasibility report dated 22nd January 2021 (ref. AS11958.210122.R1.1).
- 5.5.2 In the majority of cases, the existing floors were shown to meet the minimum required performance for both airborne and impact sound insulation.
- 5.5.3 However, impact sound insulation performance was marginal and in some cases fell slightly short of the required criteria based on the standards for refurbishment outlined in BB93.
- 5.5.4 At the time of testing, floors were generally stripped back to floorboards or had the original worn carpet. **It is understood that current proposals are to:**
- **remove all existing floor coverings and make good the existing floorboards before laying a rubber crumb acoustic underlay and 6mm plywood with the final floor finish on top;**
 - classrooms, group rooms, offices, circulation spaces and stairs will be carpeted; and that
 - non-slip vinyl will be used in the early year classrooms.
- 5.5.5 In general, the above additional floor build-up can be expected to uplift the performance of the floors to comfortably meet the required criteria in testable areas.

New Build Element

- 5.5.6 The separating floor between the Drama/Dance studio and Assembly/Dining hall is currently shown to comprise 150mm structural slab with 8mm resilient layer, UFH system on 25mm insulation and 67mm screed finish. The final floor finish will comprise and 2mm polyurethane seamless flooring system with a 5mm sheet rubber underlay.
- 5.5.7 **Exact details of the structural slab have not been made available for review at the time of writing and these will be addressed in more detail at the detailed design stage.**
- 5.5.8 Due to the presence of multiple layers of resilient material in the above build-up, the control of impact noise sources from the assembly hall to the studio below can be expected to be well controlled if implemented correctly on site.
- 5.5.9 The minimum required airborne sound insulation performance between these spaces is $\geq D_{nT,w}$ 50dB (assuming this element falls within the refurbishment category), while a suitable aspirational target for this element of the scheme is $\geq D_{nT,w}$ 55dB. Depending on final details of all elements, the current build-up may fall short of these performance requirements and will need to be considered in more detail. Further uplift of the overall performance may require increasing the thickness of the slab or providing for a suitable resiliently suspended mass-barrier ceiling in the drama studio.

5.6 ROOM ACOUSTICS

- 5.6.1 The proposed room dimensions and finishes have been reviewed for a number of typical classrooms and group rooms and recommendations for additional absorptive treatment are provided. These are based on plans provided by EWA dated May 2021 in relation with reflected ceiling plans, floor finishes and sections.
- 5.6.2 Commercially available absorptive treatments (i.e. ceiling rafts or wall panels) are generally designed to meet Class A, Class B or Class C minimum performance requirements, with Class A being the most absorptive and Class C the least.
- 5.6.3 The calculations below are based on the minimum requirements for Class A absorber unless otherwise stated. The actual performance of selected products may differ and so it is recommended that these are reviewed again when product selections have been made.

AREA	RT T _{mf} (seconds)	
	ADDITIONAL ABSORPTION REQUIRED	TARGET
Primary Classroom & Group Rooms Carpeted Floors	10-12 m ²	≤ 0.8
Laboratory / art room Vinyl Floor	33 m ²	≤ 0.8
Drama studio / Dance studio	40 m ²	≤ 1.0 / ≤ 1.5
Assembly Hall / Multi-purpose Hall	-*	0.8 – 1.5
Library Carpeted floor	-	≤ 1.2
Office	-	≤ 1.2
Reception	-	≤ 2.0

Table 6 Additional absorption treatment required for the control of reverberation times.

* It is understood that a perforated plasterboard ceiling is proposed in this area. Reverberation times would be expected to fall within the criteria proposed provided the selected product provides minimum Class C performance. This will be reviewed at the detailed design stage when data is made available from the supplier.

- 5.6.4 A sample of Classrooms and group rooms have been assessed. The exact amount of absorption to be added varies with the size of the room, but these would generally require additional absorption in the form of absorptive panels or similar. The same situation would be found in the laboratory and arts rooms. A more detailed analysis of the products, locations and surfaces will be required to ensure the suitability of the design.

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