

REPORT TITLE:

Hopwood Hall College Rochdale- Stage 4 Acoustic Strategy Report

CLIENT DETAILS:

Wilmott Dixon Construction

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Document Status and Revision Schedule

Issue/Revision	Description/Comments	Date	Prepared by	Approved by
P01	Checked & Authorised	4/10/24	JCB	MJ
P02	Latest drawings	6/11/24	JCB	MJ
P03	Acoustic mark up Plan C	21/11/24	JCB	MJ
P04	Stage 3	13/12/24	JCB	MJ
P05	Plant noise impact	7/01/25	JCB	MJ
P06	Stage 4	26/03/2025		

1 Introduction

This document draws together the Stage 4 design processes applied to date for the new education building at Hopwood Hall College Rochdale, to satisfy the Acoustic design of schools: performance standards (Building Bulletin 93, February 2015).

The proposal is to build a new four storey building containing teaching classrooms, and staff rooms.

2 Design Criteria

2.1 BB93 Acoustic Design for School

In February 2015 the Department for Education published the “Acoustic design of schools: performance standards, Building Bulletin 93”.

The acoustic conditions in schools are controlled by Part E of the Building Regulations, School Premises Regulations and the Independent School Standards, which apply to new and existing schools. School premises are also subject to the Equality Act. Requirement E4 from Part E of Schedule 1 to the Building Regulations 2010 (as amended by SI 2002/2871) states:

“Each room or other space in a school building shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use.”

Approved Document E in support of the Building Regulations gives the following guidance:

“In the Secretary of State’s view the normal way of satisfying Requirement E4 will be to meet the values for sound insulation, reverberation time and internal ambient noise which are given in Section 1 of Building Bulletin 93 ‘The Acoustic Design of Schools’, produced by DfES.” (Note DfES is now DfE).

BB93 Scope:

The scope of BB93 is clear in that it applies only to teaching and learning spaces. BB93 states that:

Requirement E4 of the Building Regulations applies to teaching and learning spaces in new buildings, and to extensions to existing buildings. The School Premises Regulations and the Independent School Standards apply to all areas of schools. The Building Regulations are not intended to cover the acoustic conditions in administration and ancillary spaces not used for teaching and learning except where they affect conditions in neighbouring teaching and learning spaces, but do require consideration to be given to adjoining areas, such as corridors, which might have doors, ventilators, or glazing separating them from a teaching or learning space.

2.2 Indoor ambient noise levels in teaching/learning classrooms.

Pace Consult scope of works include a noise survey and assessment to evaluate the noise climate at the location of the proposed building. Once the noise levels at the site of the new building will be assessed, a comprehensive internal noise assessment in teaching classrooms will be completed.

2.3 Sound Insulation in Teaching and Learning Spaces

2.3.1 BB93 Airborne Sound Insulation Requirements

Table 1 of BB93 specifies the noise activity and sensitivity levels which are used to evaluate the performance standards for airborne sound insulation. The acoustic criteria in Table 1 of BB93 are included below.

Table 2.1 – BB93 (table 1) activity noise and noise tolerance classifications

Type of Room	Room Classification for the purpose of airborne sound insulation in tables 3a and 3b	
	Activity noise (source room)	Noise tolerance
Nursery school rooms	Average	Medium
Primary – Classroom, class base, general teaching, small group		
Open plan – teaching area, resource/breakout	Average	Medium
Primary Music Room	High	Medium
Secondary music classroom, practice/group room	Very High	Low
Performance/recital room, ensemble room, recording studio	Very High	Low
Control room for recording	High	Low
Control room not for recording	Average	Medium
Lecture room	Average	Medium
Teaching space for students with special hearing and	Average	Low
SEN calming room	High	Low
Study Room (individual study. Withdrawal, remedial work,	Low	Medium
Libraries – Quiet study area	Low	Medium
Libraries –Resource area	Average	Medium
Science laboratory	Average	Medium
Design and technology – Resistant materials, CadCam	High	High
Design and technology – Electronics/control, textiles, food, graphics, design/resource area, ICT room, Art	Average	Medium
Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music	High	Low

Type of Room	Room Classification for the purpose of airborne sound insulation in tables 3a and 3b	
	Activity noise (source room)	Noise tolerance
Atrium, circulation space not intended for teaching and learning	Average	Medium
Sports hall, dance studio, gymnasium/activity studio	High	Medium
Swimming pool	High	High
Meeting room, interviewing/counselling room, video conference room	Low	Medium
Dining room	High	High
Administration and ancillary spaces		
Kitchen	High	High
Office, medical room, staff room	Low	Medium
Corridors, stairwell, coats and locker area	Average	High
Changing area, toilet	Average	High

From the table above, the following matrix taken from BB93 is used to derive the in-situ acoustic performance required between the adjoining spaces. The calculation is undertaken in both directions and the most onerous requirement is selected to move forward into the design.

Table 2.2 – BB93 (table 3a) New Build performance standards for airborne sound insulation between spaces.

Minimum $D_{nT,w}$ (dB)		Activity noise in source room (see table 1)			
		Low	Average	High	Very High
Noise tolerance in receiving room (see table 1)	High	Not Applicable	35	45	50
	Medium	40	45	50	55
	Low	45	50	55	55

2.3.2 BB93 Sound Insulation Exceptions

- Serving hatches between kitchens and multipurpose halls used for dining should be avoided where practicable, and serveries placed between kitchens and dining areas wherever possible to avoid noise transfer during meal preparation. Where this is not possible, serving hatches should be designed to have as high a level of sound insulation as practicable (not less than 18 dB Rw) and, if necessary, use of the dining hall space timetabled so that noise sensitive activities, e.g., exams, do not take place in the hall when the kitchen is in use. Where the space is used solely for dining purposes, a sound insulation serving hatch is not necessary.*
- 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 35 dB Rw. The surrounding wall containing the doorset should have a sound insulation rating of at least 45 dB Rw. Where there is an operable wall or folding partition between a teaching area and a hall, the minimum*

- *DnT,w between the spaces should be 45 dB. The end user should be made aware that the sound insulation performance of the operable wall may not facilitate simultaneous use of the spaces on either side.*
- *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 Rw, set within a wall rated at 55 dB Rw. 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 Rw.*

2.4 Sound Insulation in Corridors and Circulation Spaces

The minimum airborne sound insulation requirement between circulation spaces (e.g. corridors, stairwells) and other spaces used by pupils is given in Table 4a and 4b of BB93 for the separating wall construction and any doorset in the wall, quoted in terms of the weighted sound reduction index, R_w . Tables 4a and b are included below.

BB93 (table 4a) corridor wall sound insulation requirements (no ventilators)

Type of space used by students	Minimum R_w		
	Composite R_w of wall and glazing with no ventilator		Doorset
	New Build	Refurbishment	
• Secondary school music room • Control room for recording • Drama • Multi-purpose hall • Teaching spaces for students with special hearing or communication needs	45	40	35
• Primary music classroom • All other teaching areas	40	35	30

BB93 (table 4b) sound insulation of the corridor wall with ventilators.

Type of space used by students	Minimum R_w			Alternative to composite R_w of wall, glazing and ventilators dB, provided values in Table 4a are provided by wall, glazing and doors
	Composite R_w of wall and glazing with no ventilator		Doorset	
	New Build	Refurbishment		Minimum $D_{n,e,w} - 10 \lg N$ dB for ventilators
• Secondary school music room • Control room for recording • Drama • Multi-purpose hall • Teaching spaces for students with special hearing or communication needs	38	35	35	37
• Primary music classroom • All other teaching areas	33	30	30	32

2.5 Floor Impact Sound Insulation

The maximum impact sound pressure level requirements are shown in table 5 of BB93, these are reproduced below.

Table 2.4 – BB93 (table 5) impact sound insulation requirements

Type of Room (receiving room)	Maximum impact sound pressure level $L'_{nT,w}$ dB
Teaching space for students with special hearing and communication needs	55
Secondary music classroom Practice/group room Performance/recital room Ensemble room Control room for recording Control room not for recording	55
Nursery school rooms Primary – Classroom, class base, general teaching, small group Secondary – classroom, general teaching, seminar, tutorial, language lab Open plan – teaching area, resource/breakout Primary Music Room Lecture room Library Science laboratory Design and technology – Resistant materials, CadCam Design and technology – Electronics/control, textiles, food, graphics, design/resource area, ICT room, Art Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music Sports hall, dance studio, gymnasium/activity studio Meeting room, interviewing/counselling room, video conference room	60
Dining room, swimming pool Kitchen Office, medical room, staff room Corridors, stairwell, coats and locker area Changing area, toilet	65

2.6 Reverberation Time Requirements

The reverberation time requirements are shown in table 6 of BB93, these are reproduced below.

Table 2.5 – BB93 (table 6) performance standards for reverberation time

Type of Room (receiving room)	T _{mf} seconds	
	New Build	Refurbishment
Nursery School room Primary school: classroom, class base, general teaching area, small group room, SEN calming room	≤0.6	≤0.8
Secondary school: classroom, general teaching area, seminar room, tutorial room, language laboratory Study room (individual study, withdrawal, remedial work, teacher preparation) Science laboratory Design and technology: Resistant materials, CAD/CAM area, Electronics/control, textiles, food, graphics, design/resource area, ICT room, art	≤ 0.8	≤1.0
Open plan: Teaching area Resource/Breakout area	≤ 0.5 ≤1.2	≤ 0.5 ≤1.2
Music: Primary music room Secondary music classroom Practice/group room, volume ≤ 30 m ³ Practice/group room, volume > 30 m ³ Ensemble room, Live room Performance/recital room Control room - for recording Control room - not for recording	≤1.0 ≤1.0 ≤ 0.6 ≤ 0.8 0.6 - 1.2 1 1.0 - 1.5 ≤ 0.5 ≤ 0.5	≤1.0 ≤1.0 ≤ 0.8 ≤1.0 0.6 - 1.2 1 1.0 -1.5 ≤ 0.6 ≤ 0.6
Lecture rooms: Small (fewer than 50 people) Large (more than 50 people)	≤ 0.8 ≤1.0	≤1.0 ≤1.0

Type of Room (receiving room)	T _{mf} seconds	
	New Build	Refurbishment
Teaching space intended specifically for students with special hearing or communication needs	T ≤ 0.4 averaged from 125 Hz to 4kHz octave band centre frequencies and T ≤ 0.6 s in every octave band in this range.	≤ 0.4.
Library	≤1.0	≤ 1.2
Drama studio	≤1.0	≤ 1.0
Atrium, foyer, entrance hall, circulation space not used for teaching and learning	≤1.5	≤ 2.0
Assembly hall, multi-purpose hall (drama, PE, audio/visual presentation, assembly, occasional music),	0.8- 1.2	0.8 - 1.5
Indoor sports hall, swimming pool	≤ (1.5 - 2.0) Dependant on size of space.	≤ 2.0
Gymnasium/activity studio	≤1.5	≤ 2.0
Dance studio	≤1.2	≤1.5
Meeting room, Interviewing/counselling room, video conference room	≤ 0.8	≤ 0.8
Dining room	≤ 1.0	≤ 1.5
Administration and ancillary spaces		
Kitchen	≤ 1.5	≤ 2.0
Office, medical room, staff room	≤ 1.0	≤ 1.2
Coats and locker area, changing area	≤ 1.5	≤ 2.0
Toilet	≤ 1.5	≤ 2.0

Notes. For teaching spaces for use by students with special hearing or communication needs, the required reverberation time is expressed as the arithmetic average of the reverberation times in the 125 Hz to the 4 kHz octave bands, or the arithmetic average of the reverberation times in the one-third octave bands from 100 Hz to 5 kHz.

These values are for rooms that are finished, furnished for normal use, but unoccupied.

3 Internal Sound Insulation

3.1 Sound Insulation of Dividing Structures

3.1.1 Partition Calculations and Mark-ups

The required laboratory determined performance of each partition within the scheme has been calculated based on the methodology described within section 3.2.1 of Acoustic of schools: a design guide 2015. An excerpt of the document is provided below:

$$R_{w,est} = D_{nT,w} + 10 \lg \left(\frac{S \times T}{V} \right) + 8 \text{ dB}$$

where

$D_{nT,w}$ is the minimum weighted standardized level difference between rooms from Table 3a or 3b

S is the surface area of the separating element (m^2)

T is the maximum mid-frequency reverberation time allowed for the receiving room from Table 6, applied to all frequency bands for the purposes of the calculation.

V is the volume of the receiving room (m^3).

The likely sound reduction in the airborne sound insulation that would occur in the field, to account for less favourable mounting conditions and workmanship than in the laboratory test is assumed to be $X = 7 \text{ dB}$.

Each wall within the scheme has a calculated acoustic performance to deliver the in-situ requirement, however it is practical to group the performances together to ensure that the scheme does not get overly complex to construct. This has significant programme benefits as the partition types are limited.

The proposed acoustic strategy plans and proposed internal/external walls sound insulation has been reviewed and the acoustic proposals within them are deemed sufficient to meet BB93 recommended acoustic criteria.

-  FE0012-SRA-01-00-D-A-2210-169AcousticStrategy00Plan
-  FE0012-SRA-01-00-D-A-2215-IntWallTypes00Plan (1)
-  FE0012-SRA-01-00-D-A-2215-IntWallTypes00Plan (2)
-  FE0012-SRA-01-01-D-A-2211-169AcousticStrategy01Plan
-  FE0012-SRA-01-01-D-A-2216-IntWallTypes01Plan (1)
-  FE0012-SRA-01-02-D-A-2212-169AcousticStrategy02Plan
-  FE0012-SRA-01-02-D-A-2217-IntWallTypes02Plan (2)
-  FE0012-SRA-01-03-D-A-2213-169AcousticStrategy03Plan
-  FE0012-SRA-01-03-D-A-2218-IntWallTypes03Plan (2)
-  FE0012-SRA-01-RF-D-A-2214-169AcousticStrategyRFPlan
-  FE0012-SRA-01-RF-D-A-2219-IntWallTypesRFPlan (1)
-  FE0012-SRA-01-XX-D-A-2225-InternalWallTypes (3)

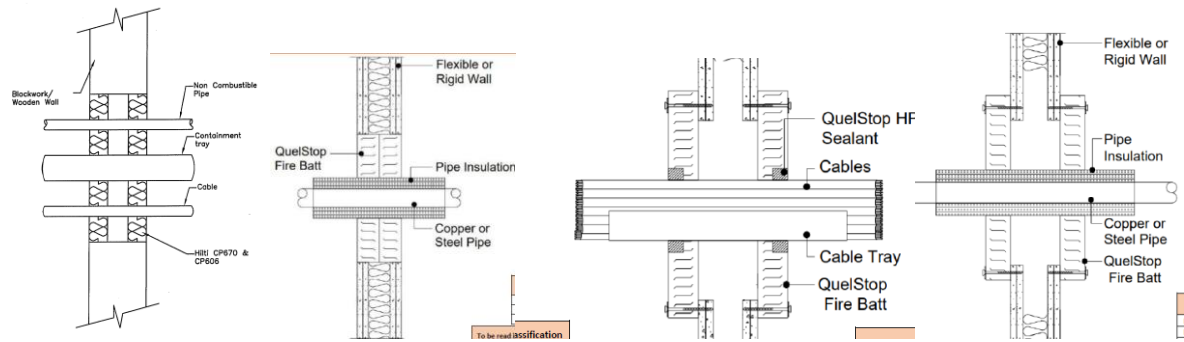
The typical external walls are included in the following drawings.

-  FE0012-SRA-01-XX-D-A-2130-182PerimeterSections1
 -  FE0012-SRA-01-XX-D-A-2131-182PerimeterSections2
-
-  FE0012-SRA-01-XX-D-A-2140-184NetZeroCarbonEnhancements
-

The sound insulation provided by the external walls are in excess of R_w 60 dB, and therefore considered adequate to meet BB93 recommended internal sound levels.

3.1.2 Service Penetrations

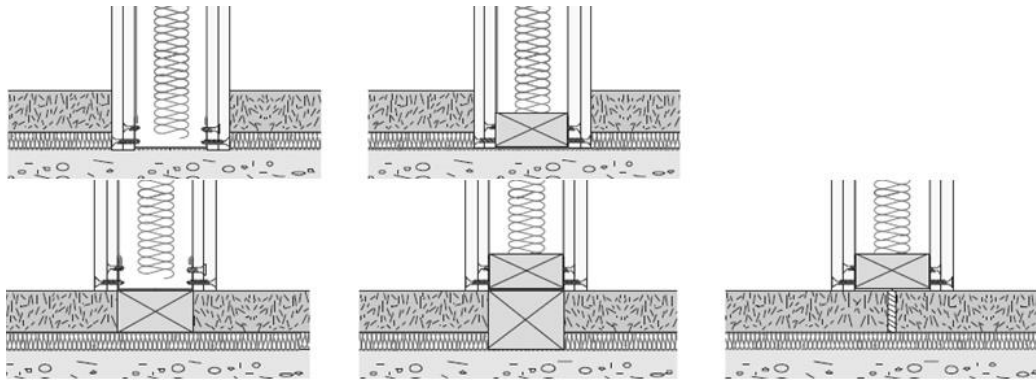
Penetrations should be avoided in walls between noise sensitive spaces (teaching and learning). Where penetrations occur, these should be as small as possible and correctly finished using a proprietary sealant system such as the Hilti (or similar) Batt system finished with Intumescent paste. See setting out diagram overleaf:



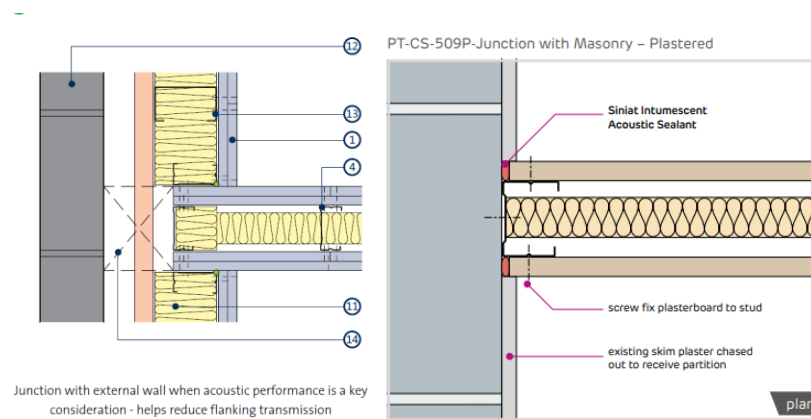
3.1.3 Flanking details

The following typical flanking details are recommended.

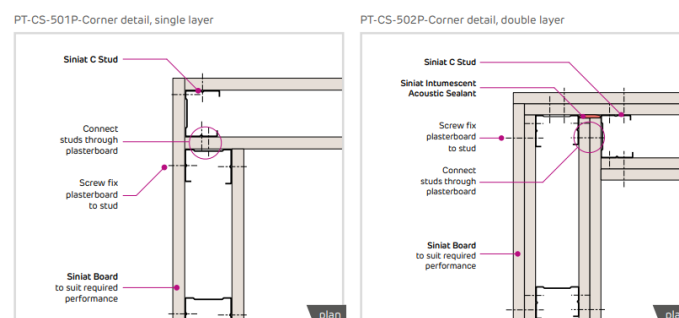
Base details

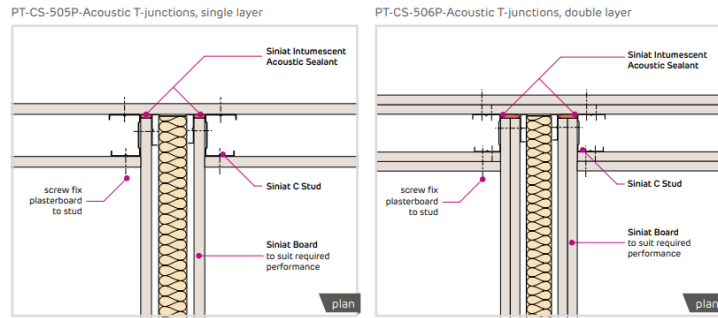


Interface external to internal wall.

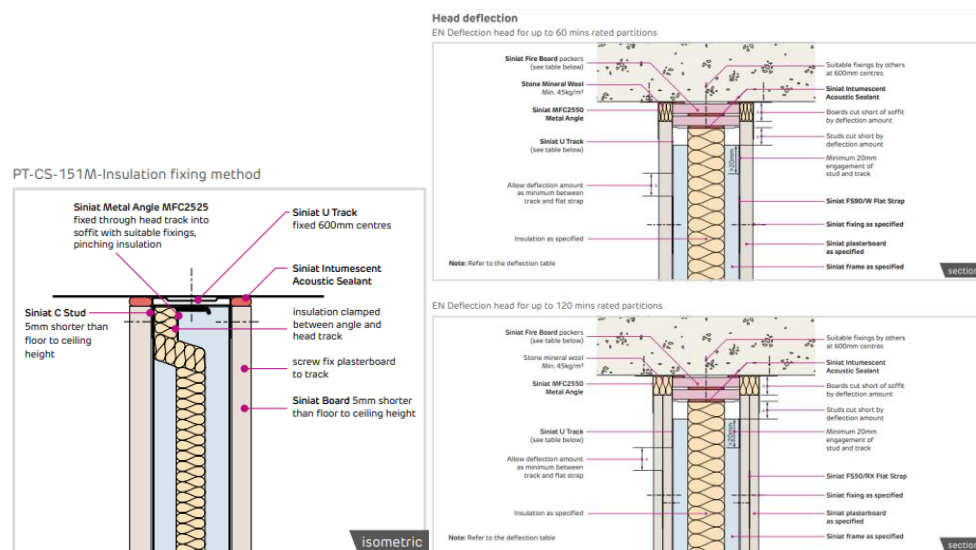


Corners and T junction



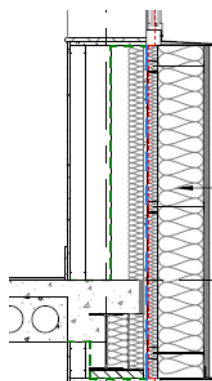


Head details/deflection



Vertical Flanking.

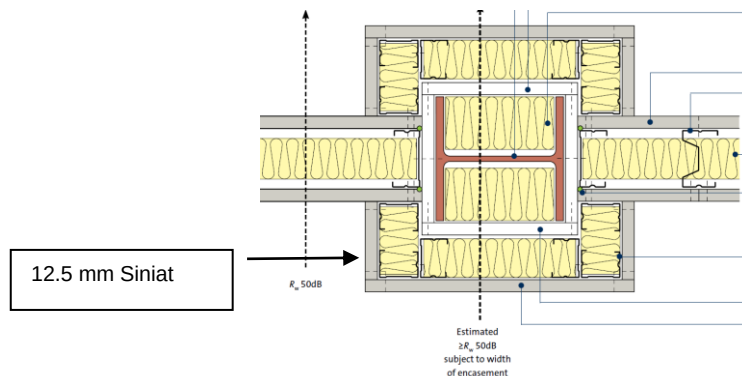
The sound transfer across the vertical flanking is going to be controlled by providing high dense mineral fibre and internal lining as shown in the image below.



The proposal is considered adequate to mitigate vertical flanking between teaching classrooms.

Encased steel column (Teaching Classrooms)

Typical encasement is shown in the image below. (Teaching classrooms with an internal wall with a sound rating of $\geq R_w$ 50 dB

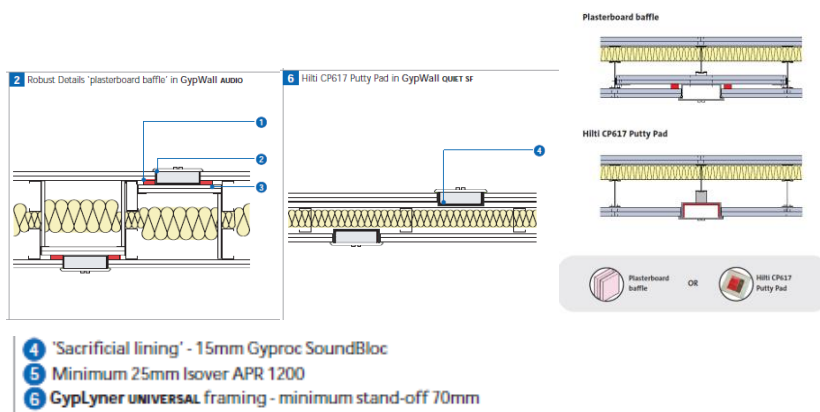


The encasement of steel column between teaching/staff rooms separated by with a wall with a sound rating of R_w 55 dB should include 2 x 12.5 mm siniat.

The encasement between teaching/staff room with a wall with a sound rating of R_w 60 dB should include 2 x 15 Siniat.

3.1.4 Socket detailing

The illustrations overleaf show different socket detailing which can be used to avoid flanking problems. Note that sockets should not be installed 'back-to-back';



3.1.5 Internal Glazing

Generally, the acoustic rating of the internal glazing (circulation areas) should match the rating of the wall, for instance the sound rating of an internal glazing within a wall with a sound rating of R_w 40 dB needs to achieve also R_w 40 dB.

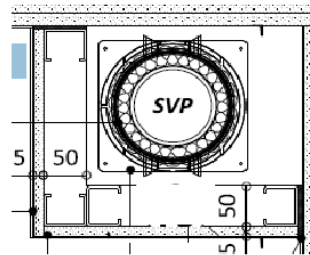
Internal glazing (circulation areas) within walls with acoustic rating of R_w 45 dB needs to achieve a rating of R_w 45 dB.

Additionally, the following acoustic rating are recommended.

Room	Internal glazing acoustic rating R_w dB
Reception	30
News Room	45
TV Studio Gallery	45

3.1.7 SVP/RWP boxing out.

The acoustic enclosure should include 1 x 15 mm sound bloc plasterboard and 25 mm insulation (i.e Isover APR1200).

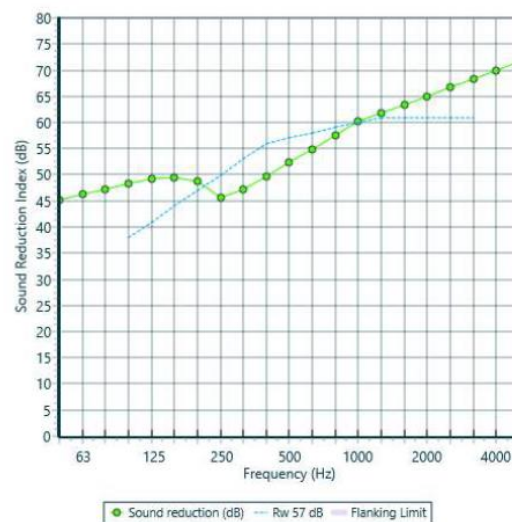


3.2 Floor Performance

The maximum sound reduction performance required to meet BB93 criteria across the floor is R_w 57 dB.

The proposed floor comprises 200mm precast hollowcore concrete planks + 75mm structural topping. The calculated sound reduction of this floor is included below.

freq.(Hz)	R(dB)	R(dB)
50	45	
63	46	46
80	47	
100	48	
125	49	49
160	50	
200	49	
250	46	47
315	47	
400	50	
500	52	52
630	55	
800	58	
1000	60	60
1250	62	
1600	63	
2000	65	65
2500	67	
3150	68	
4000	70	70
5000	72	



R_w 57 dB

The proposed floor is considered adequate to meet the criteria recommended by BB93.

Regarding the impact sound insulation, areas covered by carpet achieve the required impact sound insulation, and therefore no additional acoustic underlay will be required. However, teaching spaces with vinyl finish will require an acoustic underlay similar to Regupol 4515.

The acoustic underlay should be installed between the hollowcore plank and the structural topping on the first, second, and third teaching classrooms with vinyl finish only.

4 Rain Noise

Regarding the control of rain noise BB93 states the following:

Building Regulation submissions should demonstrate that lightweight roofs and roof glazing have been designed to provide suitable control of rain noise reverberant sound pressure level in a space (calculated using laboratory test data with 'heavy' rain noise excitation as defined in BS EN ISO 140-18. Levels during heavy rain should not be more than 25 dB above the appropriate indoor ambient noise level given in table 1 (for refurbishments, this applies only to new roofing elements and not to repairs to existing roofs))

ISO 140-18:2006 specifies a laboratory method of measurement of the impact sound insulation of roofs, roof/ceiling systems and skylights excited by artificial rainfall. The results obtained can be used for assessing the noise to be produced by rainfall on a given building element in the room or space below.

The sound pressure level is calculated using the following equation:
$$L_{p,r} = L_{w,r} + 10 \log T - 10 \log V + 14 + 10 \log S$$

Where $L_{p,r}$ is the rain noise sound pressure level in the room - dB
T is the reverberation time in the room - seconds
V is the volume of the room in m³
S is the room area m²
 $L_{w,r}$ sound power level - (when 1 m² of roof is excited) dB

Based on the above criteria the indoor ambient noise levels in teaching spaces located at 2nd floor should not exceed 60 dBA.

It is understood that concrete planks (heavy weight structure) are going to be used at roof level, therefore the roof solution is anticipated to be a deemed to satisfy solution and rain noise is not expected to be of concern.

Roof light windows over teaching classrooms should be selected to have a minimum laboratory sound rating of R_w 30 dB.

5 Reverberation Time Control

The reverberation time (RT) in teaching/learning classrooms, and social space is going to be controlled by using Class A suspended acoustic rafts. This strategy is considered adequate to meet BB93 recommended acoustic criteria (≤ 0.8 seconds teaching classrooms, and ≤ 1.2 seconds social space)

It is understood that the nursery classrooms will be dedicated essentially for the learning/teaching process, and therefore the control of reverberation time by using Class A suspended acoustic rafts to achieve a RT criteria of ≤ 0.8 seconds is considered adequate.

The RT in the circulation areas, lobbies, and stairs are going to be controlled by installing a suspended ceiling tile (It is recommended a minimum class C sound absorption).

The RT in offices and staff rooms are also to be controlled by installing Class A suspended acoustic rafts.

The proposed total number of acoustic rafts in teaching/learning/social, staff rooms, and offices are considered adequate to meet BB93 recommended acoustic criteria.

The following drawings has been reviewed and the acoustic proposals within them are deemed sufficient to meet BB93 recommended acoustic criteria.

 FE0012-SRA-01-00-D-A-3510-161CeilingTypes00Plan

 FE0012-SRA-01-01-D-A-3511-161CeilingTypes01Plan

 FE0012-SRA-01-02-D-A-3512-161CeilingTypes02Plan

 FE0012-SRA-01-03-D-A-3513-161CeilingTypes03Plan

 FE0012-SRA-01-RF-D-A-3514-161CeilingTypesRFPlan

 FE0012-SRA-01-00-D-A-4310-161FloorTypes00Plan

 FE0012-SRA-01-01-D-A-4311-161FloorTypes01Plan

 FE0012-SRA-01-02-D-A-4312-161FloorTypes02Plan

 FE0012-SRA-01-03-D-A-4313-161FloorTypes03Plan

 FE0012-SRA-01-RF-D-A-4314-161FloorTypesRFPlan

6 Contractors Provision of Suitable Product Information

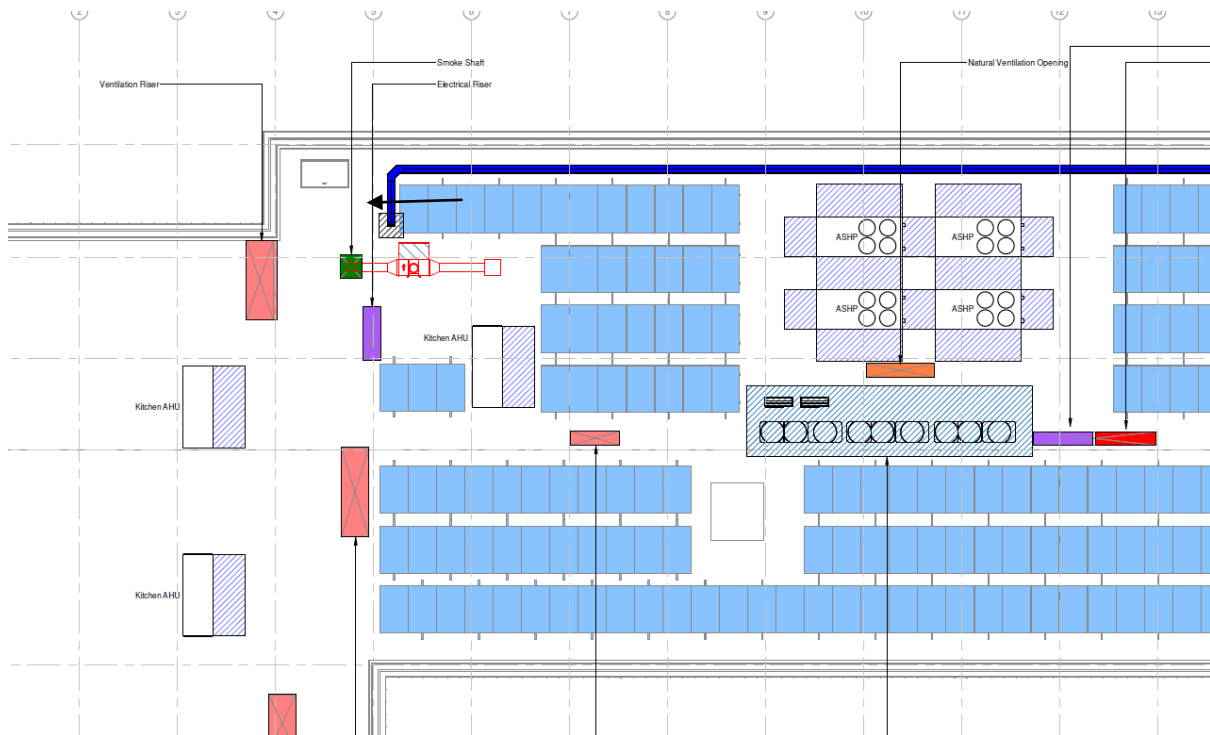
All critical internal structures, doors, proprietary glazing and non-masonry elements of the external building fabric should be tested in accordance with relevant BS EN ISO 10140-2 in a UKAS accredited laboratory to prove compliance with the performance specifications provided.

7 Plant Noise Impact Assessment.

This section includes the noise impact assessment of the plant located on the roof of the proposed school. The assessment includes the Stage 3 design information, additional noise assessment will be completed during stage 4, once all the proposed plant information is available.

7.1 Plant location and noise levels.

The plant location is included in the image below



The plant information is included below.

- 4no Clade Birch LN 120/80

		BIRCH 120/80 LN
Heating capacity (KW) -5 ambient (Design Conditions)	kW	80
Housing Dimensions Height	mm	2057
Housing Dimensions Width	mm	3144
Housing Dimensions Length	mm	1455
Inverter Drive quantity	-	1
Minimum turn down at design ambient	%	50
Refrigerant charge	kg	9
SCOPH Heating design point	° C	3.37
Sound Power	dB(A)	68.7
Sound Pressure 1m	dB(A)	50.7
Sound Pressure 10m	dB(A)	36.7

- 4no PURY-EP650YSNW-A2

OUTDOOR UNITS		PURY-EP650YSNW-A
CAPACITY (kW)	Heating (nominal)	81.5
	Cooling (nominal)	73.0
	High Performance Heating (UK)	77.4
	COP Priority Heating (UK)	74.2
	Cooling (UK)	65.3
POWER INPUT (kW)	Heating (nominal)	18.94
	Cooling (nominal)	16.59
	High Performance Heating (UK)	25.19
	COP Priority Heating (UK)	18.94
	Cooling (UK)	9.62
COP / EER (nominal)		4.30 / 4.40
SCOP / SEER		-
MAX No. OF CONNECTABLE INDOOR UNITS		50
MAX CONNECTABLE CAPACITY		50~150% OU Capacity
AIRFLOW (m³/min)	High	240 / 250
PIPE SIZE mm (in)	Gas	28.58 (1-1/8")
	Liquid	28.58 (1-1/8")
SOUND PRESSURE LEVEL (dBA)		69.0
SOUND POWER LEVEL (dBA)		88.5

- 4no PUZ-ZM100YDA

PUZ-ZM OUTDOOR UNITS		PUZ-ZM100YDA ③
SOUND PRESSURE LEVEL (dBA)		49 / 44
SOUND POWER LEVEL (dBA)	Cooling	63
WEIGHT (kg)		114
DIMENSIONS (mm)	Width x Depth x Height	1110 x 460 + 45 x 870
ELECTRICAL SUPPLY		380-415v, 50Hz
PHASE		Three
SYSTEM POWER INPUT (kW)	Heating/Cooling (nominal)	2.667 / 2.16
	Heating/Cooling (UK)	2.11 / 1.79
STARTING CURRENT (A)		3.5
SYSTEM RUNNING CURRENT (A)	Heating/Cooling [MAX]	4.09 / 3.32 [8.50]
FUSE RATING (BS88) - HRC (A)		16
MAINS CABLE No. CORES		5
MAX PIPE LENGTH (m)		100
MAX HEIGHT DIFFERENCE (m)		30
CHARGE REFRIGERANT (kg) / CO ₂ EQUIVALENT (t) - R32 (GWP 675) - 30m		3.6 / 2.43 (40m)
MAX ADDITIONAL REFRIGERANT (kg) / CO ₂ EQUIVALENT (t) - R32 (GWP 675)		2.4 / 1.62

- 3no Kitchen supply AHUs and 3no Kitchen extract fans

Frequency band [Hz]	63	125	250	500	1K	2K	4K	8K	Total
Sound power level	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(A)]
Supply air	70	82	78	77	76	74	70	60	81
Outdoor air	64	79	74	69	62	58	52	47	71
Exhaust air	71	85	80	80	80	79	76	70	85
Extract air	64	76	77	68	62	59	53	48	71
Sound break out	64	73	58	55	56	52	47	30	61

The nearest residential dwellings which have the potential to be affected by the noise emission of the proposed plant are included in the image overleaf.

7.1.1 Noise attenuation.

The following noise attenuation is recommended to meet the noise criteria.

- 4no Mitsubishi PURY-EP650YSNW-A2 external condensers

These units should be equipped with acoustic louvres (acoustic kit) with a minimum sound reduction of 10 dB.

- AHU units
Fresh air intake attenuator Insertion Losses dB

63	125	250	500	1k	2k	4k	8k
7	10	15	22	38	30	23	16

Exhaust

63	125	250	500	1k	2k	4k	8k
9	12	21	32	42	38	30	21

Nighttime operation.

During nighttime (23:00 to 7:00) the following units will operate only.

- 4no small external condensers serving the server and hub rooms.
- 1no ASHP



7.2 Plant noise impact assessment.

The calculated noise levels from the proposed plant to the nearest residential dwellings (R1, R2, and R3) is compared to the recommended plant noise criteria.

The noise criteria is specified to be 10 dB below the typical background levels. (Day time 44 L_{A90} dB, and night time 35 L_{A90} dB).

The table overleaf shows the calculated noise levels at R1 and R2 which are the most exposed residential dwellings.

Day Time Operation. All proposed plant units operating.

Receptor	Floor level	Calculated sound levels dBA	Receptor	Floor level	Calculated sound levels dBA	Receptor	Floor level	Calculated sound levels dBA
R1	GF	33	R2	GF	37	R3	GF	36
R1	F 1	35	R2	F 1	38	R3	F 1	37
R1	F 2	36	R2	F 2	40	R3	F 2	38
R1	F 3	36	R2	F 3	41	R3	F 3	38
R1	F 4	38	R2	F 4	43	R3	F 4	40
R1	F 5	38	R2	F 5	43	R3	F 5	40
R1	F 6	39	R2	F 6	43	R3	F 6	41
R1	F 7	39	R2	F 7	43	R3	F 7	41
R1	F 8	39	R2	F 8	43	R3	F 8	41
R1	F 9	39	R2	F 9	43	R3	F 9	41
R1	F 10	39	R2	F 10	43	R3	F 10	41
R1	F 11	38	R2	F 11	42	R3	F 11	40
R1	F 12	38	R2	F 12	42	R3	F 12	40
R1	F 13	38	R2	F 13	42	R3	F 13	40
R1	F 14	38	R2	F 14	42	R3	F 14	40
R1	F 15	38	R2	F 15	42	R3	F 15	40
R1	F 16	38	R2	F 16	42	R3	F 16	40
R1	F 17	38	R2	F 17	41	R3	F 17	40
R1	F 18	38	R2	F 18	41	R3	F 18	40
R1	F 19	38	R2	F 19	41	R3	F 19	39

Night Time operation. Units ON are: 4no small external condensers serving the server and hub rooms, and 1no ASHP.

Receptor	Floor level	Calculated sound levels dBA	Receptor	Floor level	Calculated sound levels dBA	Receptor	Floor level	Calculated sound levels dBA
R1	GF	19	R2	GF	23	R3	GF	22
R1	F 1	21	R2	F 1	25	R3	F 1	23
R1	F 2	22	R2	F 2	26	R3	F 2	24
R1	F 3	23	R2	F 3	27	R3	F 3	24
R1	F 4	24	R2	F 4	29	R3	F 4	26
R1	F 5	25	R2	F 5	30	R3	F 5	26
R1	F 6	25	R2	F 6	30	R3	F 6	27
R1	F 7	26	R2	F 7	30	R3	F 7	27
R1	F 8	26	R2	F 8	30	R3	F 8	27
R1	F 9	26	R2	F 9	30	R3	F 9	27
R1	F 10	25	R2	F 10	30	R3	F 10	27
R1	F 11	25	R2	F 11	30	R3	F 11	27
R1	F 12	25	R2	F 12	29	R3	F 12	27
R1	F 13	25	R2	F 13	29	R3	F 13	27
R1	F 14	25	R2	F 14	29	R3	F 14	27
R1	F 15	25	R2	F 15	29	R3	F 15	27
R1	F 16	25	R2	F 16	29	R3	F 16	27
R1	F 17	25	R2	F 17	28	R3	F 17	27
R1	F 18	25	R2	F 18	28	R3	F 18	26
R1	F 19	25	R2	F 19	28	R3	F 19	26

As can be seen from the above tables, the calculated noise levels from the plant roof at the most exposed residential facade are 10 dB below the pre-existing background noise which is a positive indication that the noise emission from the proposed plant units is likely to have a low impact.

Therefore, the proposed mitigation measures implemented for the plant roof noise, which are included in section 7.1.1 of this report are effective in minimizing its impact on the nearby residential area.

8 Conclusions

The latest proposed layouts of the Hopwood Hall College Rochdale project have been assessed against BB93 criteria.

The proposals for partition constructions, door specifications, rain noise and reverberation time controls are discussed within this report.

The noise emission from the proposed plant roof is 10 dB below the existing background noise, which is generally considered a substantial reduction and a good sign that the new noise source will have negligible impact on the surrounding environment.