FORMANT.

STRAIGHTFORWARD ACOUSTIC DESIGN

CLYDACH VALE ALN SCHOOL

STAGE 3 ACOUSTIC DESIGN REPORT

Project no. P1308
Report ref. 26CC05-FOR-10-XX-T-OJ-0003
Date 27-09-2024
Revision P01

Formant Ltd, Ty Newydd Farm, Abergavenny, Monmouthshire NP78DW I W www.formant.co.uk I E enquiries@formant.co.uk

FORMANT.
STRAIGHTFORWARD ACOUSTIC DESIGN

CONTENTS

REVISION HISTORY

Date	Revision	Notes
27/09/2024	P01	For information

EXEC SUMMARY

This report sets out the key acoustic design issues, performance criteria and proposed acoustic design solutions for the proposed new development at Clydach Vale ALN School. It also provides the design-stage evidence of compliance for both BREEAM and the Building Regulations.

CLIENT BRIEF AND ACOUSTIC CRITERIA

The building has been designed to comply with the acoustic performance criteria set out in Building Bulletin 93 (BB93) and the relevant BREEAM credits (Hea5 and Pol5). We met with the client team in July 2023 to discuss the criteria in BB93 for children with special hearing or communication needs and how this might be applied to the unique needs of Clydach Vale ALN School. At this stage, no Alternative Performance Standards (APS) are proposed for the building, however there are some areas where we have clarified the interpretation of BB93 and **we assume that the client team accept the assumptions in Sections 2 and 3 of this report which were also included in the Stage 2 acoustic report for client approval**.

ACOUSTIC DESIGN STRATEGY

The site is not exposed to significant traffic noise levels and a noise survey at the site measured low ambient and background sound levels. However, there is an industrial estate to the southeast of the site and the character of the noise from industrial activities could be problematic for some students, therefore we have recommended some acoustic enhancements for classrooms on this elevation of the building. Mitigating the industrial noise outside the building is not practicable as the site topography makes provision of a noise barrier very tricky. However the site layout has considered the issue and the proposed car park location will provide an increased amount of distance attenuation for any industrial noise.

The proposed ventilation strategy is a hybrid one, using mechanical ventilation for the majority of the time, with open windows during periods of warmer weather. This is acceptable acoustically on most elevations but we recommend classrooms with open windows are avoided on the east elevation facing the industrial estate.

Acoustic ratings for internal partitions, doors and glazed screens will generally be in line with the BB93 standard for mainstream schools, with 5 dB enhancements proposed for some locations where pupils may benefit from higher levels of privacy. During Stage 3 we have marked up a set of architectural plans to show the exact recommended ratings for each one of these elements in the school.

The recommended room acoustic design strategy uses Class A acoustic ceiling tiles to provide the majority of the acoustic absorption required to meet the BB93 criteria. Additional acoustic wall panels are recommended for the sensory rooms (where practicable), the main hall and some taller circulation/meeting spaces. The room acoustic calculations show classrooms are capable of compliance with the BB93 primary school criterion (0.6 secs) but will slightly exceed the ‘enhanced’ criteria for pupils with special hearing and communication needs.

Building services noise control initial guidelines are set out in Section 7 including the outcome of the Stage 3 assessment of air source heat pump noise.

1 INTRODUCTION

Formant has been appointed by Morgan Sindall to advise on the acoustic design of the proposed new-build ALN school at the site of the existing 'Pavilions' office park in Clydach Vale, Rhondda Cynon Taf. The new school buildings are required to comply with Building Bulletin 93 (BB93), as described in Approved Document E of the Building Regulations.

This report details the acoustic criteria which apply to the development and initial acoustic design advice which will need to be developed by the rest of the design team during RIBA Stage 4.

2 CLIENT ACOUSTIC BRIEF

This section clarifies any areas where we have had to interpret the acoustic criteria in BB93/ADE to meet the project-specific goals for the school.

2.1 BB93 CRITERIA FOR ALN SCHOOLS

BB93 defines 'children with special hearing or communication needs' (SHoCN) as "*children with permanent hearing impairment or with severe or complex needs including:*

- *speech, language and communication difficulties*
- *visual impairments*
- *fluctuating hearing impairments caused by conductive hearing loss*
- *attention deficit hyperactivity disorders (ADHD)*
- *an auditory processing disorder or difficulty*
- *being on the autistic spectrum."*

In relation to special school accommodation, BB93 states that:

"*the required acoustic conditions will depend on a pupil's individual special needs and may be accommodated by a specialist provision (e.g. a quiet room for private study and communication, or an assisted listening device for participation in general teaching), or by improving the general acoustic conditions of teaching and learning spaces. Advice from a specialist acoustic consultant should be sought to allow the school client body to make an informed decision on the appropriate provision for the school's intended use.*

The acoustic criteria for these types of accommodation should be signed off by the school client body in the same way as alternative performance standards (APS) as the particular needs of the pupils and the activities they take part in may vary widely from one school to another and within the same school.

The figures for rooms intended specifically for pupils with special hearing or communication needs in mainstream accommodation given in the tables in section 1 are a starting point and may not be suitable for the particular needs of the children in some types of accommodation."

2.2 ACOUSTIC DESIGN STRATEGY

We discussed the various BB93 acoustic criteria with the client team at a meeting in June 2024 and identified a strategy which suits the specific needs of this school. The school building will be designed to fully comply with the BB93 'new-build' standards as a minimum. However, many of the children attending the school would fall under the '*special hearing or communication needs*' description in BB93, therefore enhancements are proposed for specific rooms and/or specific issues, as summarised in the table below:

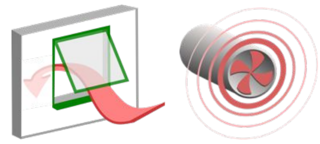
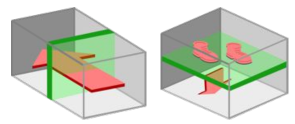
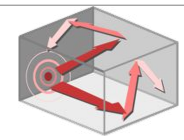
Acoustic issue and typical BB93 criteria	Proposed strategy	Notes
 **Indoor ambient noise levels (IANL):** Standard classroom: 35 dBA SHoCN: 30 dBA	Noise break-in to be fully compliant with SHoCN criterion. Ventilation system noise to comply with SHoCN target where practicable; 'standard classroom' upper limit. Provide cooling to most exposed ALN classrooms to reduce the need to open windows.	Provision of mechanical ventilation will help to mitigate noise from the industrial estate (good). However, some children may be adversely affected by ventilation system noise, but all practicable steps will be implemented to reduce it to a level where it has minimal impact.
 **Internal sound insulation:** Varies according to adjacencies SHoCN criteria typical 5 dB higher than BB93 standard classrooms	Apply SHoCN criteria as a general design strategy, but accept that slight shortfalls are acceptable where costs for enhancements might be prohibitive.	Applies to partitions, doors, internal glazing, floor/ceilings and moveable partitions. During Stage 3 we have identified specific areas where enhancements would be effective for pupils and would offer good value for money.
 **Reverberation times (RT):** Varies depending on room use, but a standard primary classroom is ≤0.6secs. SHoCN criterion is more complex, with ≤0.4secs overall plus individual frequency band requirements.	Comply with SHoCN overall target of ≤0.4secs via BB93 *calculation only.* On-site minimum standard: compliance with standard primary school classroom (≤0.6 secs) to allow for real-world conditions (e.g. unfurnished rooms, hard floor finishes, etc).	Some smaller rooms would likely comply with the SHoCN criteria. For those which do not, the difference between 0.6 and 0.4 secs RT would not be perceptible to most people. The cost of targeting full SHoCN compliance in all rooms on-site would be significant and would result in loss of wall space and increased building height.
Specialist spaces: Support spaces/Calming rooms	Where these open directly off classrooms, it will not be possible to achieve high levels of sound insulation. Instead, we will upgrade partitions/doors by 5 dB compared to BB93 and keep IANL/RT as low as practicable.	If high levels of sound insulation are required, these rooms will need to open off corridors, not directly off the classroom.
Specialist spaces: Sensory rooms	Target as low RT as possible and consider further 5 dB sound insulation upgrades (depending on room adjacencies).	There is no specific criterion in BB93 for these rooms, therefore the proposed standards are an enhancement on a BB93 small group room.
Specialist spaces: Main Hall	Target the standard BB93 'multi-purpose hall' criteria.	It is difficult to achieve significant enhancements on this standard in a large hall.

Table 1: Proposed acoustic design strategy (as discussed and agreed with the client in June 2024)

3 ACOUSTIC CRITERIA

Acoustic issue	Performance standard	Room (and adjacency, if applicable)
Internal ambient noise level (IANL) $L_{Aeq,30\ mins}$	35 dB	All other teaching, support and sensory rooms
	40 dB	Resource areas, Rebound Therapy, Staffroom, Offices
	45 dB	Circulation
	50 dB	Hydrotherapy Pool, Kitchen, Toilets
Airborne sound insulation (walls and floors) $D_{nT,w}$	45 dB	Between Offices/Meeting Rooms
	50 dB	Between Classrooms and teaching spaces generally
Rain Noise L_{Aeq}	IANL +25 dB	All teaching spaces
Reverberation time T_{mf}	0.4 secs	Sensory rooms, Support spaces/Calming rooms
	0.6 secs	All other teaching spaces
	0.8 secs	Offices, Meeting Rooms
	0.8-1.2 secs	Main Hall
	1.5 secs	Hydrotherapy Pool
Plant noise emissions Noise Rating, NR (internal) or **Rating Sound Level,** $L_{A,r}$ (external)	NR25	Classrooms and teaching spaces generally
	NR35	Resource areas, Rebound Therapy, Staffroom, Offices
	NR40	Circulation
	NR45	Hydrotherapy Pool, Kitchen, Toilets
	38/35 dB	Noise sensitive receptors outside the site (day/night)

Table 2: Acoustic criteria

Notes on Table 1:

- The IANL limits include contributions from building services noise as well as environmental noise break-in. For naturally ventilated spaces, the total noise level may exceed the IANL limit by up to 5 dB.
- Sound insulation criteria depend on the specific room adjacencies. Adjacencies shown in the table are typical of those which occur in this project, but there may be others which must also comply with BB93. The criteria do not apply to walls which contain an inter-connecting door.
- In some cases, it may not be practicable or cost-effective to achieve the $D_{nT,w}$ 50 dB sound insulation target between classrooms and other teaching spaces. We will review these instances on a case-by-case basis and determine the most appropriate sound insulation strategy.
- The room acoustic criteria and compliance requirements for classrooms are discussed in more detail in Section 6.

4 ACOUSTIC DESIGN: EXTERNAL NOISE

4.1 BASELINE NOISE SURVEY

A baseline noise survey was undertaken between 14-17 May 2024. Full details of the survey are provided in the Baseline Noise Survey Report (ref REP001, dated 21 May 2024). A summary of the key results is below:

4.1.1 AMBIENT SOUND LEVELS

Measured daytime ambient noise levels ranged from 45-53 dBL_{Aeq}. The noise logger, extended out of the east facing window of one of the existing buildings recorded average levels of 50 dBL_{Aeq} during daytime hours. The results at each measurement position are shown below:

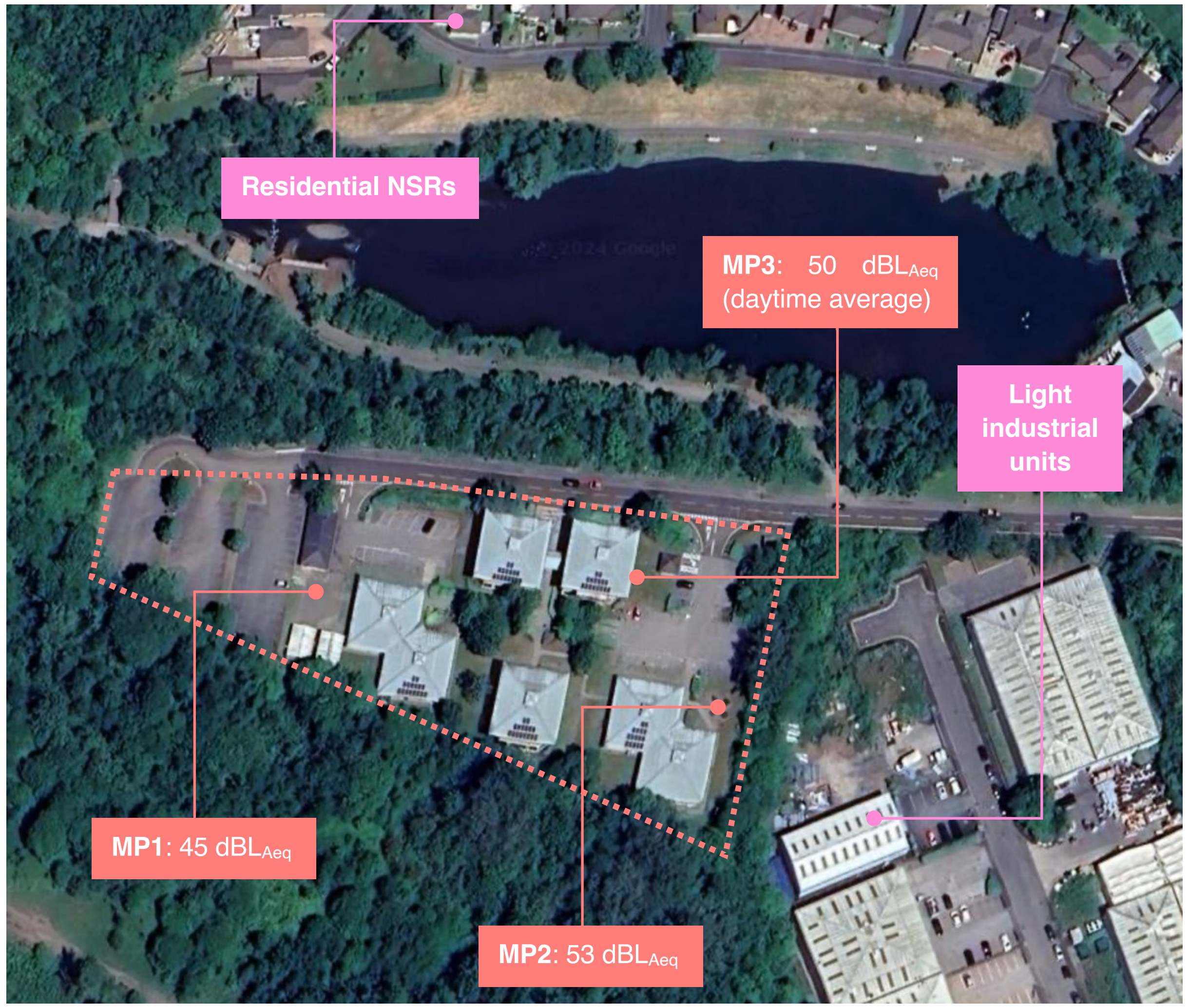


Figure 1: Existing site aerial photo showing measurement locations and NSRs.

4.1.2 BACKGROUND SOUND LEVELS

Background sound levels were 43 dBL_{A90} (daytime) and 40 dBL_{A90} (night time) and these figures have been used to set building services plant noise limits.

4.2 VENTILATION STRATEGY

BB93 provides internal ambient noise level (IANL) criteria for each different type of space within a school. In general, most teaching spaces in a new-build school have an IANL criterion of 35 dB, with a +5 dB relaxation permitted for naturally ventilated spaces. BB93 states that the IANL criteria can normally be achieved with:

- Single-sided ventilation where external noise levels exceed the IANL criteria by up to 16 dB, and
- Cross-ventilation where external noise levels exceed the IANL by up to 20 dB.

In short this means that most teaching spaces can typically be naturally ventilated where external noise levels do not exceed $L_{Aeq,30min}$ 51 dB for single-sided ventilation or 55 dB for cross-ventilation.

In ALN Schools the preference is to target an IANL criterion of L_{Aeq} 30 dB, with a 5 dB relaxation for natural ventilation. This is likely to be achievable in terms of environmental noise break-in with windows partially open, but it may not be achievable with mechanical ventilation systems operating as well. We are already working closely with the M&E engineer to try and achieve L_{Aeq} 30 dB in as many spaces as possible, and the upper limit of L_{Aeq} 35 dB limit should be achievable in all spaces.

For classrooms on the east elevation overlooking the industrial estate we have recommended the ventilation strategy be designed to avoid the need for opening windows.

4.3 INDUSTRIAL NOISE AFFECTING THE SITE

Industrial noise impacts are typically assessed using BS 4142:2014 *Methods for rating and assessing industrial and commercial sound.* However the method in that document is not considered suitable in this case because it compares the industrial noise to the background sound level and in this location, the background sound level is dominated by industrial noise, hence the method would imply a significant adverse noise impact, regardless of the design of the proposed development.

The results of the survey show that industrial noise did dominate the soundscape to the southeast of the site. The nature of noise from industrial estates may be more disturbing for some ALN pupils than the more constant noise one might expect from a road or from building services plant.

On this basis it is necessary to consider industrial noise in designing the site layout and the buildings themselves. We advised during Stage 2 that the following noise mitigation should be incorporated into the design:

1) External play areas facing the industrial estate should be avoided.
2) Building massing should aim to use the school buildings to screen the rest of the site from noise on the industrial estate.
3) Internal space planning should aim to avoid noise sensitive windows overlooking the industrial estate (e.g. locating plantrooms, kitchens and staffrooms along this elevation rather than teaching spaces).

4.4 BUILDING ENVELOPE SOUND INSULATION

Given the low ambient noise levels at the site, no additional sound insulation upgrades are required for the proposed façade or roof structure.

4.5 RAIN NOISE INSULATION

The proposed roof structure comprises a concrete deck, which will be inherently good at resisting rain drumming noise and does not require detailed calculations for BB93. If any lightweight roof areas are introduced, please confirm the build-up and we will calculate the rain noise levels.

5 ACOUSTIC DESIGN: INTERNAL SOUND INSULATION

The sound insulation between internal spaces is important to ensure teaching/study spaces are not unduly disturbed and to achieve speech privacy, where this is required.

The BB93 internal sound insulation requirement between two spaces depends upon:

1. the **noise levels** of activities taking place in one room and
2. the **sensitivity** of activities in the next room to noise disturbance

The minimum sound reduction criteria for typical adjacencies in the proposed building are defined in BB93 in terms of Weighted Level Difference, $D_{nT,w}$. Note that for some spaces, there are no on-site performance criteria between rooms, but the element itself (e.g. the door or corridor partition) must provide a laboratory sound insulation rating (R_w) instead.

5.1 INTERNAL PARTITION AND DOOR RATINGS

The minimum sound insulation performance for each internal partition and door has been marked up on a set of plans in the Appendix to this report. The following partition build-ups are suggested to meet each rating:

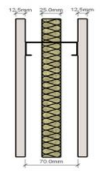
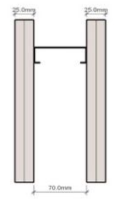
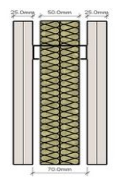
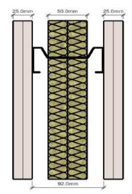
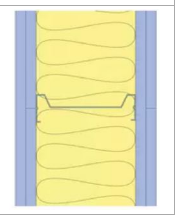
Typical location	Lab Sound Insulation (R_w)	Possible build-up	Overall width (mm)	
Corridor walls	40 dB	**12.5 mm plasterboard** (min. 9 kg/m²), either side of **70 mm metal C stud** with **25 mm mineral wool** in the cavity	97	
Walls containing an inter-connecting door and enhanced corridor walls	45 dB	**2 x 12.5 mm plasterboard** (min. 9 kg/m²), either side of **70 mm metal C stud** with **no mineral wool** in the cavity	122	
Between teaching spaces	50 dB	**2 x 12.5 mm plasterboard** (min. 9 kg/m²), either side of **70 mm metal C stud** with **50 mm mineral wool** in the cavity	122	
Hall, Music Room	56 dB	**2 x 12.5 mm dense plasterboard** (min. 10.5 kg/m²), either side of **92 mm metal Acoustic stud** with **50 mm mineral wool** in the cavity	144	
Sensory rooms	63 dB	**2 x 15mm dense plasterboard** (min 12.5 kg/m²), either side of **146 mm Acoustic stud** with **150 mm mineral wool** in the cavity	212	

Table 3: Typical partition buildups for costing

5.1.1 PARTITION DETAILING

All partitions must be built full height from slab-to-slab. Achieving the on-site performance is also heavily dependent on good workmanship, detailing of service penetrations and flanking junctions (see Section 5.5).

5.2 MOVEABLE PARTITIONS AND ROLLER SHUTTERS

Moveable partitions typically cannot provide the same level of sound insulation as fixed partitions and they frequently fall well short of their laboratory sound insulation ratings when tested on-site, even with very high specification systems. If the moveable wall is required to provide a degree of acoustic separation between the two spaces, we would recommend a rating of R_w 53 dB, with the aim that it may realistically be capable of achieving around $D_{nT,w}$ 40 dB on-site.

Roller shutters are typically only capable of providing very low sound insulation ratings. Acoustic shutters can achieve up to R_w 40 dB but these are heavy duty shutters with a significant cost premium. The preference would be to avoid roller shutters in wall which provide an acoustic separating function.

We note that there is a moveable wall between the Medical Treatment room and the Nurse Base. **It is highly unlikely that any degree of speech privacy or confidentiality can be achieved with a moveable wall separating the two rooms and this may prevent the rooms being used concurrently for medical consultation or treatment.**

5.3 INTERNAL GLAZING

During Stage 3 we have reviewed the proposed internal glazing and advised on areas where it is not advisable due to the fact that it cannot achieve the same levels of sound insulation as a fixed partition. Our recommendations have been incorporated into the architects' partition layout plans.

Where internal glazing is proposed in corridor walls, BB93 requires the composite sound insulation performance of the entire corridor walls (including glazing) to be at least R_w 38 dB. In order to achieve this, the following selections are proposed (NB: the glazing specification applies to the unit as a whole, including any framing):

Typical location	Lab Sound Insulation (R_w)	Typical build-up
Corridor walls (up to a max. 1 m²)	35 dB	10 mm toughened single glazing
Corridor walls (>1m²)	37 dB	12.8 mm acoustic laminate single glazing

Table 4: Internal glazing requirements

5.4 INTERNAL DOORS

The minimum ratings for acoustic doors are shown on the mark-ups in the Appendix. A suitable R_w 30 dB door blank would be a 44 mm solid core timber door (minimum 27 kg/m²). A suitable R_w 35 dB door blank would be a 54 mm solid core timber door (minimum 33 kg/m²).

In order to meet the acoustic criteria, **the ratings apply to the doorset not just the door blanks, i.e. effective compression seals are required around the full perimeter as well as a suitable threshold seal.** Vision panels within doors should not reduce the overall sound insulation performance of the doorset. Acoustic doors should not be undercut or have grilles for ventilation or any other purpose.

Some of the doors which require acoustic ratings are a door-and-a-half design. It should be noted that these doorsets will require a rebated meeting stile with acoustic seals or astragals such as those shown in Figure 2. Whichever design is adopted, the **doorset**, not just the door blanks, must achieve the required R_w rating.

Figure 2 Acoustic meeting stile options for 'door-and-a-half' design

5.5 FLOOR/CEILING SOUND INSULATION

We understand that the structural floor comprises a composite concrete slab on a profiled metal deck with a maximum thickness of around 150 mm and no screed topping. Based on experience of previous projects, this slab, in combination with a standard lay-in-grid ceiling, will provide around R_w 50-55 dB which is capable of meeting the airborne sound insulation performance for all adjacencies.

5.5.1 ENHANCED SOUND INSULATION CEILINGS

Ceiling enhancements are not required for BB93 compliance in any areas. However we recommend they are included in the ground floor Food Tech room which is located beneath the Music room to provide additional sound insulation. A higher specification sound insulating ceiling tile e.g. Rockfon Artic dB46 would be suitable.

5.5.2 IMPACT NOISE

There is a requirement to reduce impact noise to meet the criteria in **Error! Reference source not found.**. In carpeted spaces, no additional mitigation is required. **In hard floor spaces (including vinyl, lino, timber and tiled) located above acoustically sensitive spaces, acoustically resilient underlay is required with a minimum impact performance of ΔL_w 10 dB.** There is no requirement to provide resilient underlay in ground floor spaces.

5.6 FLANKING SOUND TRANSMISSION

It is important that the design of flanking elements does not compromise the sound insulation performance of an acoustically rated partition or floor construction. To achieve this, flanking paths should normally be designed to be 10 dB better than the partition or floor. It will be necessary to pay careful attention to acoustic detailing for:

1) Horizontal flanking via common steel members (in particular, roof cross-bracing, which should ideally not span above acoustic partitions)
2) Horizontal flanking via interfaces with the roof and/or external walls
3) Vertical flanking via the façade (slab edge)
4) Moveable wall head-roof junction interface

The key acoustic principles for some critical junctions are set out below.

5.6.1 HEAD DETAILS

Head details for roof-partition abutments will need to ensure that a good seal is provided with the profiled metal deck. A suitable detail is illustrated below:

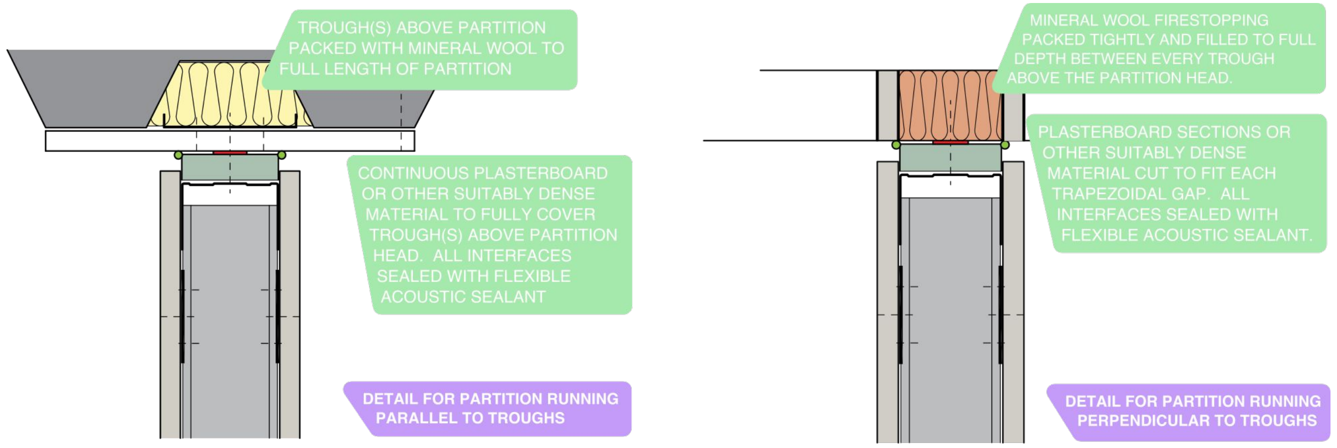


Figure 3: Head details for acoustic partition meeting profile steel deck (acoustic principles only)

5.6.2 PARTITION JUNCTION DETAILS

Acoustic partition junctions must ensure there are no continuous lightweight elements (e.g. corridor wall linings and façade wall linings) spanning both rooms. Examples are illustrated in Figure 3 below.

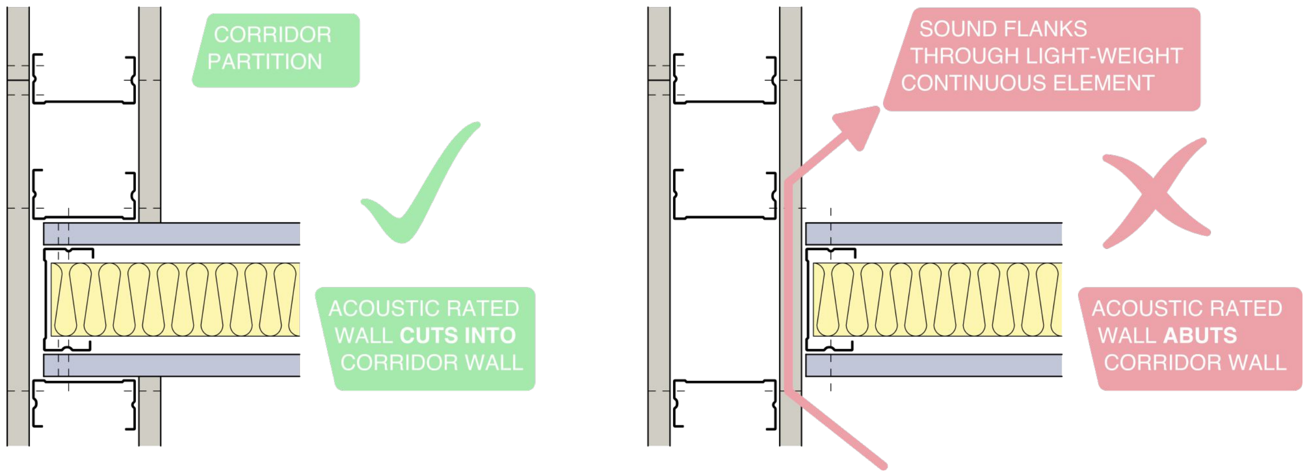


Figure 4: Corridor wall junctions to minimise flanking transmission (acoustic principles only)

5.7 BUILDING SERVICE PENETRATIONS

Detailed advice on building service distribution routes and sealing service penetrations is provided in Section 7.3.2 of this report.

6 ACOUSTIC DESIGN: ROOM ACOUSTICS

Good room acoustics are essential to ensure clear communication between teachers and students. For classrooms and study spaces, this means keeping the reverberation time (RT) down to a suitably short figure by provision of acoustic absorption. In general, the strategy is to provide mineral fibre lay-in-grid ceilings similar to those shown in Figure 5.

As well as providing absorption in classrooms to improve speech clarity, absorptive ceilings are required in corridors and circulation spaces to control reverberant noise build-up and to minimise disturbance to other parts of the school.

Figure 5: Acoustically absorptive mineral fibre ceilings

6.1 CLASSROOMS, STUDY SPACES AND CIRCULATION

The BB93 ‘enhanced’ room acoustic criteria for classrooms designed specifically for pupils with special hearing and communication needs are more complex than a standard primary school classroom, which simply uses a single-figure mid-frequency reverberation time (T_{mf}) of ≤0.6 seconds. The ‘enhanced’ criteria consider the reverberation time (T) at all frequencies individually as follows:

a) T ≤ 0.4 secs averaged from 125 Hz to 4kHz octave band centre frequencies and
b) T ≤ 0.6 s in every octave band in this range

BB93 goes on to state that *“APSs are commonly required for these rooms and should be agreed by an acoustician and the school client body”*. This issue was discussed with the client during our acoustic workshop (see Section 2 and Table 1).

RT calculations for a typical classroom show that with a Class A ceiling, the classrooms should in theory be capable of compliance with the ‘enhanced’ criteria in each octave band, but will fall slightly short of the overall target as shown below:

Octave band centre frequency (Hz)	125	250	500	1000	2000	4000	8000	Average (125Hz - 4kHz)
Predicted reverberation time, T (secs)	0.58	0.46	0.43	0.46	0.44	0.44	0.44	0.45
Comparison with BB93 ‘enhanced’ criteria	-0.02	-0.14	-0.17	-0.14	-0.16	-0.16	-0.16	+0.05

Table 5: Acoustic calculation results for a typical classrooms

In real-world conditions, we would expect a slightly higher RT than the above calculation results, but we would still expect the RT to be compliant with 0.6 secs overall target. This is still a low RT and will provide an excellent room acoustic environment for learning.

6.2 SENSORY ROOMS

The sensory rooms would all benefit from acoustic wall panels, wherever this does not pose a clash with operational requirements (e.g. if projection onto a white wall is required, or if the wall panels could be damaged by impacts). There is no upper limit to the required quantities of wall panels – i.e. if the entire wall area can be covered, this would provide an acoustic environment which helps maintain a 'calm' feel, improves the sound quality of any sound system in the room and minimizes reverberant noise levels (both intrusive noise and noise generated by the occupants).

Please note that the recommendation for acoustic wall panels is not to achieve compliance with the BB93 room acoustic criteria, it is a best practice guidance to provide excellent acoustic conditions for the sensory rooms.

6.3 CORRIDORS AND CIRCULATION

Minimum Class C ceilings are required in all corridors, stairwells, reception areas and other circulation spaces. This is a requirement to comply with ADE but does not require testing on site. If there is no significant cost premium to provide a Class A ceiling, then this would be our recommendation.

6.4 HALL ACOUSTIC FINISHES

The height of the main hall means that acoustic absorption is required on the walls as well as the ceiling in order to meet the room acoustic criteria. The recommended acoustic absorption strategy for the Hall is:

- Full Class A ceiling tile (or equivalent absorptive finish) throughout
- 115 sqm Class A acoustic wall panels (e.g. GBAcoustics PET Felt panels) distributed evenly over at least two non-opposite walls and located as low as possible, and no higher than 75% of the room height above FFL.

The calculation to demonstrate compliance in the Hall is provided below:

Surface	Description	Absorption coefficients			Area (m²)	Absorption Area (Sabines)		
		500Hz	1kHz	2kHz		500Hz	1kHz	2kHz
Floor	Lino	0.03	0.04	0.04	175	5.3	7.0	7.0
Ceiling	Mineral fibre ceiling tile (Class A)	1.00	0.95	1.00	131	131.5	124.9	131.5
Walls (high level)	Plasterboard + min wool	0.08	0.06	0.06	486	38.9	29.2	29.2
Windows	Glazing	0.05	0.03	0.02	0	0.0	0.0	0.0
Wall Treatment 1	Acoustic wall panel (uncovered)	1.00	1.00	0.95	115	115.0	115.0	109.3
Wall Treatment 2	Curtains - Heavy Wool Serge	0.65	0.56	0.59	0	0.0	0.0	0.0
Ceiling Treatment	Horizontal acoustic ceiling raft	1.00	1.00	1.00	0	0.0	0.0	0.0
Total absorption area						290.6	276.1	276.9
						Reverberation time		
T= 0.161V/A seconds						1.1	1.1	1.1

6.5 SUMMARY OF ACOUSTIC ABSORPTION STRATEGY

Space	Minimum ceiling acoustic absorption	Additional acoustic wall panels (Class A)
Hall	Class A (e.g. Rockfon Tropic or similar)	115 m² distributed on at least two non-parallel walls and no higher than 75% of the room height.
Atrium/double-height entrance corridor	Class A (e.g. Rockfon Tropic or similar)	10 m²
Sensory Rooms	Class A (e.g. Rockfon Tropic or similar)	Acoustic linings (e.g. 12 mm PET felt) on all available wall area where there is no clash with functional requirements of the room.
Double-height Wellbeing Meeting Space	Class A (e.g. Rockfon Tropic or similar)	12 m²
Hydrotherapy Pool	Class A perforated roof liner or similar	None
All other teaching/study spaces	Class A (e.g. Rockfon Tropic or similar)	None
All other occupied spaces, all buildings (inc. Meeting Rooms, Offices Cloaks, Kitchens, Toilets)	Minimum Class C, recommended Class A	None

Table 6: Minimum acoustic absorption requirements for all spaces

7 ACOUSTIC DESIGN: M&E NOISE CONTROL

7.1 ENVIRONMENTAL PLANT NOISE EMISSIONS

7.1.1 PLANT NOISE LIMITS

Background sound levels at the site were 43 dBL_{A90} (daytime) and 40 dBL_{A90} (night time) and these figures have been used to set building services plant noise limits based on BS 4142/BREEAM. For BREEAM Pol 5, the rating sound level limits at nearby NSRs are 5 dB below the background sound levels, i.e. **38/35 $dBL_{A,r}$ (day/night).**

BB93 does not stipulate plant noise limits outside the window of a classroom, however it is necessary to comply with the IANL criteria in Table 1 in the presence of any noise from external plant. We therefore propose **plant noise limits of $L_{A,r}$ 40 dB outside classroom windows**. This is based on achieving plant noise break-in of less than 25 dBA via a partially open window.

Please note that the plant noise limits apply to all plant cumulatively. Therefore, individual plant items may need to be attenuated well below the overall limits.

7.1.2 ASHP NOISE

During Stage 3 we have built a 3D computer noise model of the site to assess the rating sound levels of the initial ASHP selections. The distance to the nearest residential properties is substantial at this site, so the limiting factor for the proposed plant is the proximity to the nearest classroom windows and the rooftop ventilators for the Hall. The output of the model is shown in the noise contour plots below:

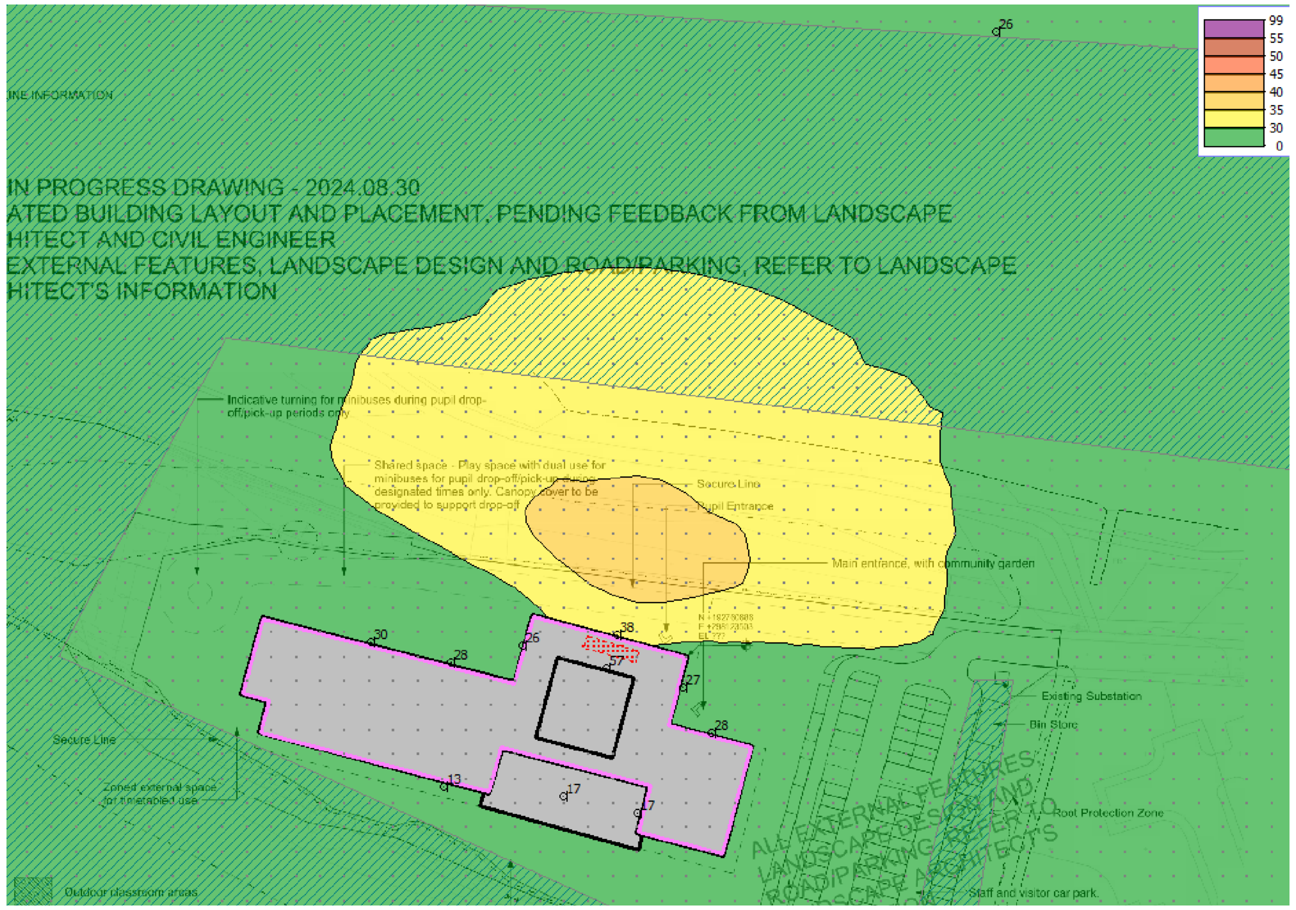


Figure 6: Plant noise contour plot at 4 m above ground level

The results of the model show that the ASHP noise is predicted to be 26 dB at the nearest NSR, which is comfortably below the BREEAM limits.

At the nearest school hall windows (north elevation of hall pop-up roof) the noise level is predicted to be 57 dBA, which exceeds the level at which the windows can be open for natural ventilation. If open windows are required for the hall, these should be on other elevations of the roof pop-up. Noise levels at the other classroom windows are no higher than 38 dB which means that the ASHP is compliant with the noise limits.

7.1.3 MVHR AND AHU ENVIRONMENT-SIDE ATTENUATORS

We have not reviewed the specifications for MVHR/AHU environmental noise emissions, but they are likely to require attenuators on their environmental-side ductwork in order to meet the noise limits. We recommend that the **noise from each individual inlet/outlet should be restricted to**

- **35 dBA at 1 m for wall-terminated units and**
- **45 dBA at 1 m for roof-mounted units.**

We assume that the attenuator supplier will specify attenuators with insertion losses which can meet these limits.

7.1.4 PLANT NOISE FEATURE CORRECTIONS

Should the external plant noise exhibit any audible acoustic features (tonality, intermittency, etc.) at the location of the NSRs, additional penalties should be applied, in line with the guidance set out in BS 4142. Based on similar plant used on other schemes, we have assumed no feature corrections are required, but this should be confirmed with the manufacturers.

7.1.5 BREEAM POL5

The initial BS 4142 assessment undertaken during Stage 3 confirms that the proposed plant is compliant with the noise emissions criteria and the design stage requirement of BREEAM Pol 5. Once full plant selections and locations are finalised we will update the assessment to confirm compliance.

For the credit to be awarded, the M&E subcontractor will need to supply confirmation that they have installed the M&E plant in line with the selections and assumptions in this assessment.

7.2 INTERNAL PLANT NOISE CONTROL

7.2.1 VENTILATION STRATEGY

Full details of the acoustic issues relating to the ventilation strategy are covered in Section 4.2.

7.2.2 MVHR NOISE (INTERNAL)

It is critical that all internal plant selections comply with the internal noise criteria in Table 1, with particular focus on the noise of the proposed MVHR units. We have identified a risk of case-radiated noise issues due to the fact the proposed design strategy involves MVHR units above the classroom ceilings which serve multiple rooms. It is possible to attenuate the down-duct noise with standard attenuators, but experience on past projects is that the room noise target od L_{Aeq} 30 dB is very challenging to achieve with this arrangement.

Duct silencers will be required on both room-side ductwork branches (insertion losses to be specified by the silencer manufacturer). Fan speeds for the units must also be selected to ensure that case radiated noise does not exceed the room noise criteria.

We reviewed an initial MVHR selection provided by TB&A during Stage 2 and concluded that it would result in case radiated noise levels up to 8 dBA above the room noise target. We understand TB&A are exploring alternative selections with manufacturers and we will review those selections once finalized to ensure they are capable of compliance.

It is possible that primary and secondary attenuators will be required to meet the IANL limits in the classrooms which contain the MVHRs and we recommend the costplan includes an extra-over cost allowance for this.

7.2.3 PLANT ROOM NOISE LEVELS

The noise levels within the plant room will need to be controlled to minimise the noise transmission within the building, and noise break-out to the external environment. Plant room noise levels should not exceed NR65.

7.2.4 PLANT FIXINGS AND VIBRATION

Fixings connecting significant building services items (e.g. fans/boilers/pumps) to the building structure should be resiliently mounted if there is any risk of the IANL criteria being exceeded.

7.2.5 HAND DRYERS

If the proposed layouts feature pupil toilets which open directly (i.e. without doors) off teaching spaces we would recommend noisy hand dryers be avoided as the level and character of the noise can be problematic for some SEN pupils. Ideally paper towels would be provided instead. If this is not desirable, we recommend acoustic doors be provided to the toilets.

7.2.6 PIPEWORK, DRAINAGE AND SIPHONIC DRAINAGE

Waste water and rainwater pipes should ideally not pass through classrooms. Where this is unavoidable, pipes should be boxed in with mineral wool and two layers of 12.5 mm plasterboard. Siphonic drain pipes should be fixed via acoustically resilient pipe fixings and boxed in with 2 layers of dense plasterboard (e.g. Soundbloc, min 12.5 kg/m²) and min. 50 mm mineral wool.

7.3 DUCTWORK AND CROSSTALK

7.3.1 DUCTWORK DESIGN AND INSTALLATION

Ductwork should be installed to ensure a minimum of regenerated noise and laminar airflow within the system by incorporating:

1. Gradual bends,
2. Gradual changes in cross-sectional area/long transition pieces, and
3. Rectangular ductwork with a near unity aspect ratio.

Spigot arrangements should not contribute to regenerated noise within ducts or cause turbulent airflow to terminal components. Ductwork should be installed to ensure no audible self-noise (i.e. rattling/ringing). Grilles and diffusers should be selected such that they do not result in any significant levels of airflow regenerated noise at normal operational air velocities.

7.3.2 BUILDING SERVICES ROUTING

One of the most common causes of acoustic test failures is unnecessary and/or poorly sealed building services penetrations. Wherever possible, all building services distribution should be via corridors, not through acoustic partitions. This concept is illustrated in Figure 7 and applies to ventilation, pipework and electrical services.

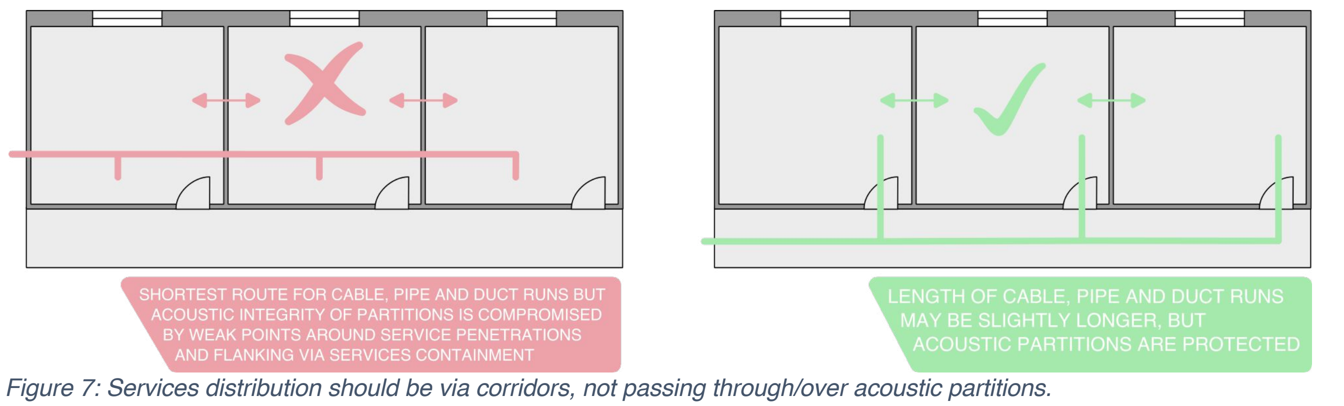


Figure 7: Services distribution should be via corridors, not passing through/over acoustic partitions.

7.3.3 BUILDING SERVICES PENETRATIONS

If it is not possible to route services away from acoustic partitions, then acoustic service penetrations will be required and the following general guidance applies:

1. All penetrations should be formed with the minimum practicable clearance.
2. The remaining gap should be packed tightly with mineral wool and sealed using a collar of material with surface weight 9 kg/m² extending at least 50 mm past the edge of the penetration.
3. All interfaces should be sealed using a non-hardening flexible acoustic sealant.
4. If present, lagging (acoustic/thermal) shall be removed from the section of duct penetrating the partition.
5. Soil/rainwater pipework routed through ceiling voids shall be avoided where possible. Where necessary, pipework shall be routed via an acoustic enclosure with acoustic access panels for any rodding eyes.
6. Pugging bags (e.g. clay/mortar/sand) should be used to fill larger gaps after the installation of electrical services e.g. cable trays, conduits etc.
7. Where ablative mineral wool fire-batts are used to close up acoustic penetrations, we recommend that a single 40 mm fire-batt is suitable for walls rated R_w 40 dB (i.e. corridor walls) but walls with any higher ratings should have a double fire-batt. **Services routing should ensure that walls rated R_w 55 dB or higher do not contain any building services penetrations.**

8 BREEAM CREDITS

Up to four credits are available for acoustic design issues under BREEAM Education 2018 and **all four credits are considered to be achievable** based on the current design proposals:

8.1 HEA5

Three credits are available under Hea5 provided that the building meets the acoustic performance standards and testing requirements relating to sound insulation, indoor ambient noise level and room acoustics. The criteria are based on BB93. Design stage compliance is demonstrated as follows:

Credit	BREEAM Requirement	Compliance demonstrated where?
First	Achieve the performance standards set out in Section 1 of Building Bulletin 93: Acoustic design of schools: performance standards, February 2015 (BB93) relating to airborne sound insulation between spaces and impact sound insulation of floors.	Section 5 of this report
Second	Achieve the indoor ambient noise level standards set out within Section 1 of BB93 for all room types.	Section 4 of this report
Third	Room acoustics (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 Section 1 of BB93. **Open plan teaching spaces** achieve the performance requirements relating to reverberation time and STI set out within Section 1 of BB93. *[Not applicable]* **Corridor and stairwells**, for those that give direct access to teaching and study spaces, achieve the performance requirements relating to sound absorption.	Section 6 of this report

Table 7: BREEAM Hea 5 design stage compliance

8.2 POL5

One credit is available where a noise impact assessment compliant with BS 4142:2014 is commissioned and the noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, is at least 5 dB lower than the background noise throughout the day and night. An initial BS4142 assessment was undertaken during Stage 3 and this will be updated with the final selection of building services plant. We expect the assessment to show compliance with the BREEAM criterion and the credit under Pol5 can be targeted.

8.3 SUITABLY QUALIFIED ACOUSTICIAN

The assessment and design work detailed in this report have been undertaken by Paul Driscoll, MIOA. Paul can be considered to be 'suitably qualified' for the purposes of a BREEAM assessment because:

1) He has over 19 years relevant experience working as an acoustic consultant in the UK, working on projects in all sectors of the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures; and
2) Paul is a Member of the Institute of Acoustics.

8.4 DEMONSTRATING COMPLIANCE

A programme of acoustic measurements will be carried out by a compliant test body in accordance with the acoustic testing and measurement procedures outlined below.

SOUND INSULATION TESTS

Measurements of sound insulation (airborne and impact) will be made between a sample of teaching spaces and other noise sensitive spaces, in accordance with the relevant part of BS EN ISO 16283 series. Where possible, measurements will be conducted between one in four pairs of adjacent noise sensitive rooms.

REVERBERATION TIME MEASUREMENTS

Measurements of reverberation time will be made in accordance with the engineering grade (or better) requirements of BS EN ISO 3382-2:2008 and in each receiver room.

INDOOR AMBIENT NOISE MEASUREMENTS

Noise level measurements will be made in at least one in ten noise sensitive rooms and in at least four rooms in which noise levels can be expected to be greatest either because they are on the noisiest façade or because they are on a naturally ventilated façade.

ENVIRONMENTAL NOISE EMISSIONS MEASUREMENTS

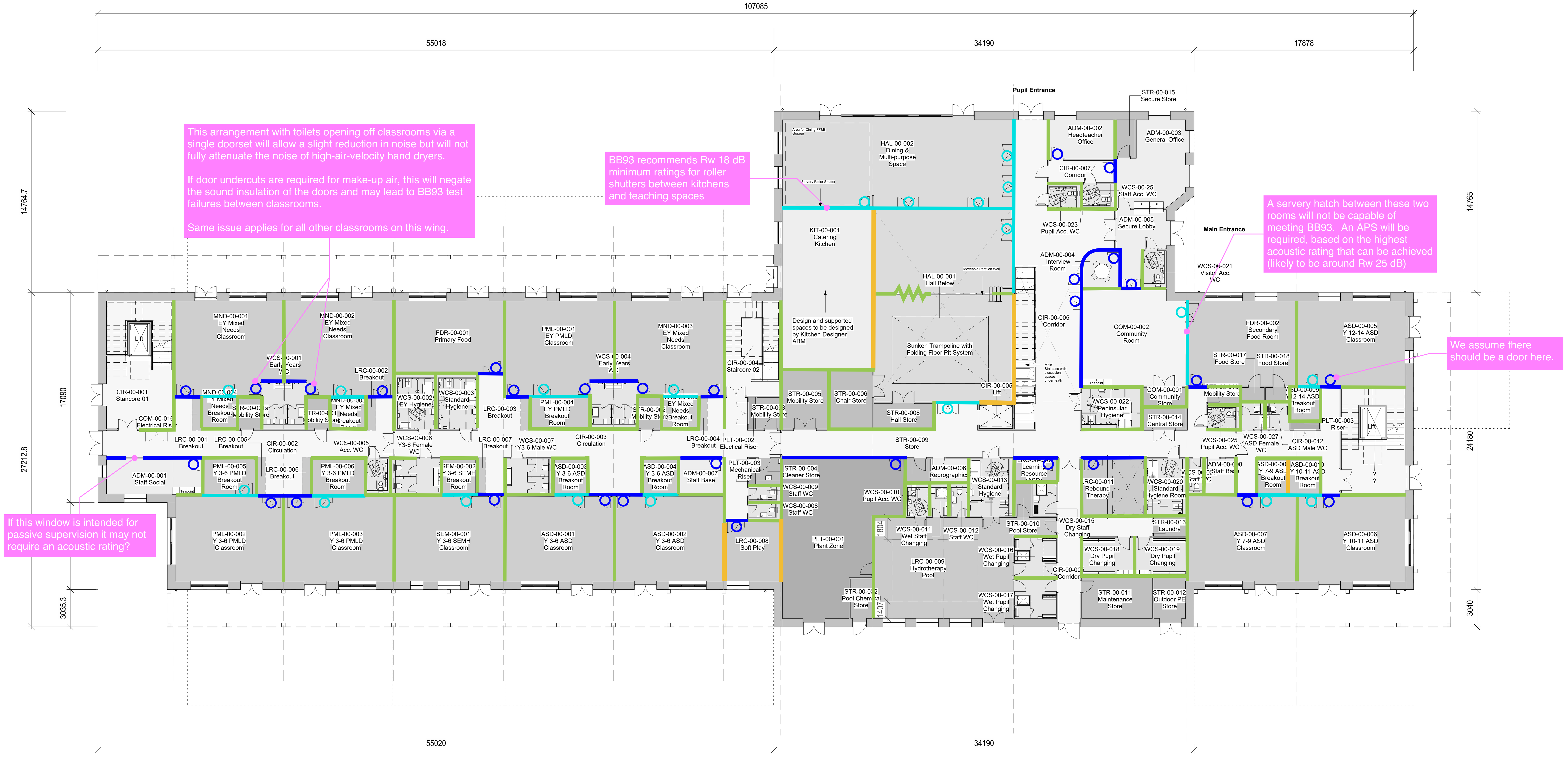
There is no requirement to measure environmental noise emissions to demonstrate compliance with Pol5.

APPENDIX – ACOUSTIC MARKUPS

Revised plan for coordination - 16.09.2024 DRAFT

Please note that the following items shown on the plans are under review/ further RIBA Stage 3 design development:

- External and internal windows, doors and glazing
- Staircases and lifts
- Sanitaryware, cubicle layout (Work In progress, pending coordination)
- Structural grids



GENERAL NOTES:

1.

2.

3.

NOTE

1.

2.

FORMANT.
STRAIGHTFORWARD ACOUSTIC DESIGN

SOUND INSULATION MARK-UP

Date: 16 Sept 2024
Rev: P03
By: PD

PARTITIONS

- Rw 40 dB
- Rw 45 dB
- Rw 50 dB
- Rw 56 dB
- Rw 63 dB

MOVEABLE WALLS

- Rw 53 dB

DOORS

- Rw 30 dB
- Rw 35 dB

Internal glazing ratings TBC once screen sizes are finalised.

-14.68°

Rev.	Date	Description	By	Chk'd	App'd
P01	25/07/24	ISSUED FOR INFORMATION	JS	CP	KH

Drawing Suitability: FOR INFORMATION
Status: S0

AtkinsRéalis
No.2 Capital Quarter, Tyndall Street, Cardiff, CF10 4BZ, United Kingdom
T: 02920 485 159 www.atkinsréalis.com

Client
Morgan Sindall Construction / Rhondda Cynon Taf County Borough Council

Project Title
NEW ADDITIONAL LEARNING NEEDS SCHOOL (3-19 YEARS), CLYDACH

Drawing Title
GENERAL ARRANGEMENT PLAN - LEVEL 00

Scale	Designed	Drawn	Checked	Authorised
1 : 200	AY	JS	CP	KH
Original Size	Date	Date	Date	Date
A1	15/07/2024	17/07/2024	24/07/2024	25/07/2024

Drawing Number: 26CC05-ATR-31-00-D-A-011000
Revision: P01

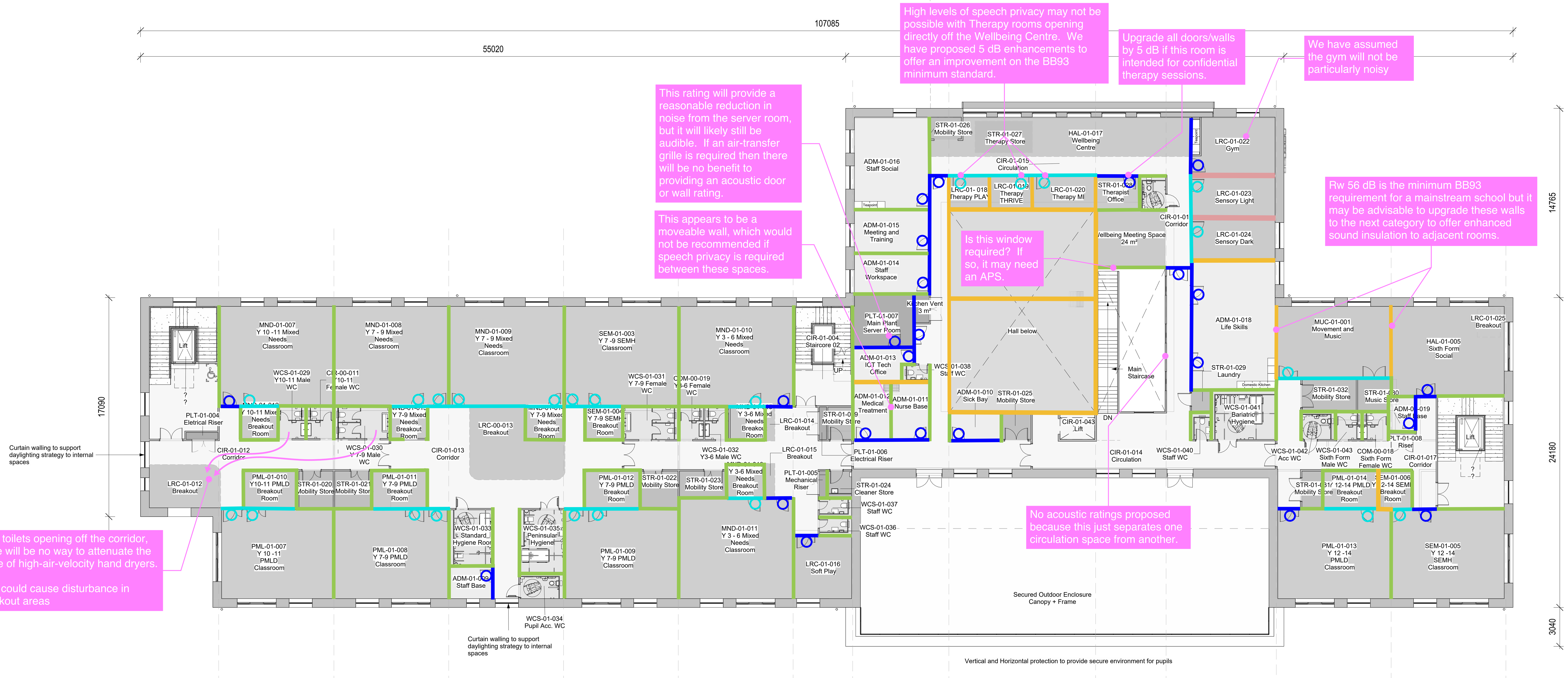
Work in-Progress 16/09/2024 11:37:36

Atkins Project Number: 26CC05

Revised plan for coordination - 16.09.2024 DRAFT

Please note that the following items shown on the plans are under review/ further RIBA Stage 3 design development:

- External and internal windows, doors and glazing
- Staircases and lifts
- Sanitaryware, cubicle layout (Work In progress, pending coordination)
- Structural grids



FORMANT.
STRAIGHTFORWARD ACOUSTIC DESIGN

SOUND INSULATION MARK-UP

Date: 16 Sept 2024
Rev: P03
By: PD

PARTITIONS

- Rw 40 dB
- Rw 45 dB
- Rw 50 dB
- Rw 56 dB
- Rw 63 dB

MOVEABLE WALLS

Rw 53 dB

DOORS

- Rw 30 dB
- Rw 35 dB

Internal glazing ratings TBC once screen sizes are finalised.

Rev.	Date	Description	By	Chk'd	App'd
P01	25/07/24	ISSUED FOR INFORMATION	JS	CP	KH

Drawing Suitability: **FOR INFORMATION** — Status: **S0**

AtkinsRéalis
No.2 Capital Quarter, Tyndall Street, Cardiff, CF10 4BZ, United Kingdom
T: 02920 485 159 www.atkinsréalis.com

Client
Morgan Sindall Construction / Rhondda Cynon Taf County Borough Council

Project Title
NEW ADDITIONAL LEARNING NEEDS SCHOOL (3-19 YEARS), CLYDACH

Drawing Title
GENERAL ARRANGEMENT PLAN - LEVEL 01

Scale	Designed	Drawn	Checked	Authorised
1 : 200	AY	JS	CP	KH
Original Size A1	Date 15/07/2024	Date 17/07/2024	Date 24/07/2024	Date 25/07/2024

Drawing Number: 26CC05-ATR-31-01-D-A-011001 — Revision: P01

Work in-Progress 16/09/2024 11:37:51
Atkins Project Number: 26CC05