

Stage 3 acoustic design considerations.

This document sets out the key acoustic design items identified during coordination meetings with the Architect, to be further developed at Stage 4 once technical design of the final accepted refurbishment works begins.

1. Scope of proposed refurbishment works.

As part of the Next Chapter project, a range of refurbishment work packages are proposed to the existing John Rylands Institute and Library, ranging from a comprehensive refurbishment of the existing ground floor entrance and reception space, to reduced scope renovation works within the historical, listed building. The acoustic design brief has therefore been developed based on the acoustically relevant scope of works as follows:

- **Building envelope:**
Limited to minor alterations to existing ground floor Reception space only.
- **Internal sound insulation:**
Limited to new-build elements proposed at ground floor level only.
- **Control of reverberation:**
Predominantly limited to ground floor level refurbishment spaces and first floor imaging suite;
Heritage constraints significantly restrict feasible acoustic quality improvements on upper floors within the historical listed building.
- **Building services design:**
Some elements of new building services to be introduced, predominantly at roof level, to improve and expand current mechanical services provision;

The key areas of acoustic design with regards to the proposed refurbishment works are summarised below for ease of reference.

2. Primary Events Space.

The main focus of the refurbishment intervention within the existing ground floor Reception Area comprises the creation of a flexible events space that is acoustically separated from the new Entrance and Retail area to enable suitable conditions for lectures, seminars, and quieter events to take place.

2.1 Internal sound insulation.

2.1.1 Minimum sound insulation recommendations.

Acoustic privacy between the event space and the adjacent Reception and Retail area is expected to be limited due to existing continuous services ductwork providing supply air into both spaces, and flanking around the continuous external glazed panels along the building envelope perimeter.

A new glazed separating wall is being provided to physically and acoustically separate the events space from the entrance area. It is understood from the current architectural proposals that a 'crittal style' glazed screed is preferred, with a full-height hinged door integrated within it to allow to and from the events space. The recommended minimum sound insulation performances for these elements are as follows:

- **Glazed screen wall: R_w 40 dB**
The above performance is typically achievable by double-glazing or thick single pane configurations, but should be considered in conjunction with the proposed framing systems. Suppliers to advise on suitable products to match the desired aesthetic, to enable a detailed review during Stage 4.
- **Full-height hinged door: R_w 30 dB**
Similarly to the above, double-glazing configurations or thicker single glazed configurations should typically achieve this performance, however please note threshold seals along the perimeter of the doorframe will be required, inclusive of the bottom threshold for a sufficient control of noise transfer through gaps in the structure to be controlled. Suppliers to advise on suitable products to match the desired aesthetic, to enable a detailed review during Stage 4.

Note: Whilst the above strategy endeavours to deliver a good level of acoustic separation between the Main Events space and the Reception Area, the existing site constraints do not allow for a high level of acoustic privacy between the two spaces, noisy activities in the retail space are likely to be audible within the main events space and could potentially cause noise disturbance during quiet events taking place. Consideration should therefore still be given to develop of space management strategy in both spaces.

2.1.2 Considerations on detailing.

Following coordination workshops with the Architect during Stage 3, a strategy has been agreed whereby the existing oval lining to the structural columns on the new partition would be stripped out and replaced with a standard drylining boxing-in, which works well acoustically. For detailing purposes, it is recommended that this comprise 2 layers of normal density plasterboard, with the cavity packed in with mineral fibre.

As best practice it is recommended that the glazed partition be installed from finished floor level and extend and abut to the structural beam encasement above the partition line. The lateral edges of the framed system should be recessed into the first layer of the column plasterboard boxing-in.

From discussions with the Architect to date, it is understood a similar detailing strategy to the above is being explored for the horizontal structural beam encasement at the head of the glazed screen partition.

A review of the technical design details package should be carried out in the next stage to ensure the proposed details above have been implemented to ensure the sound insulation performance of the partition is not limited.

2.2 Reverberation control.

A mid-frequency reverberation time ranging from T_{mf} 1.0 to 1.2 seconds is recommended to control reverberant noise build-up to improve acoustic comfort and provide a reasonable level of speech intelligibility from events within this space.

From coordination with the Architect and Mechanical Engineer during Stage 3 design, it is understood that perforated metal tiles are proposed within the retained existing coffered ceiling areas to provide a visual screening to the proposed cooling units housed within, as well as assist in reverberation time control.

It is understood from a review of the Stage 3 Architectural package received for review on 14/04/2023 that 4no rafts comprised of 21 900x900 perforated metal tiles are proposed within the ceiling coffers across the room.

A 3D acoustic model of the Main Events Space has been created using the acoustic simulation software package Odeon to investigate the required finishes to provide suitable room acoustics within the space. A screenshot of the modelled geometry, as retrieved from the Stage 3 architectural package, is provided in Figure 1. A screenshot of the acoustic model is provided in Figure 2. While the preliminary and indicative furnishing scheme within the Architects drawings has not been modelled, a nominal allowance for the effect of furniture breaking up lateral reflections across the space has been taken into account in the modelling exercise carried out.

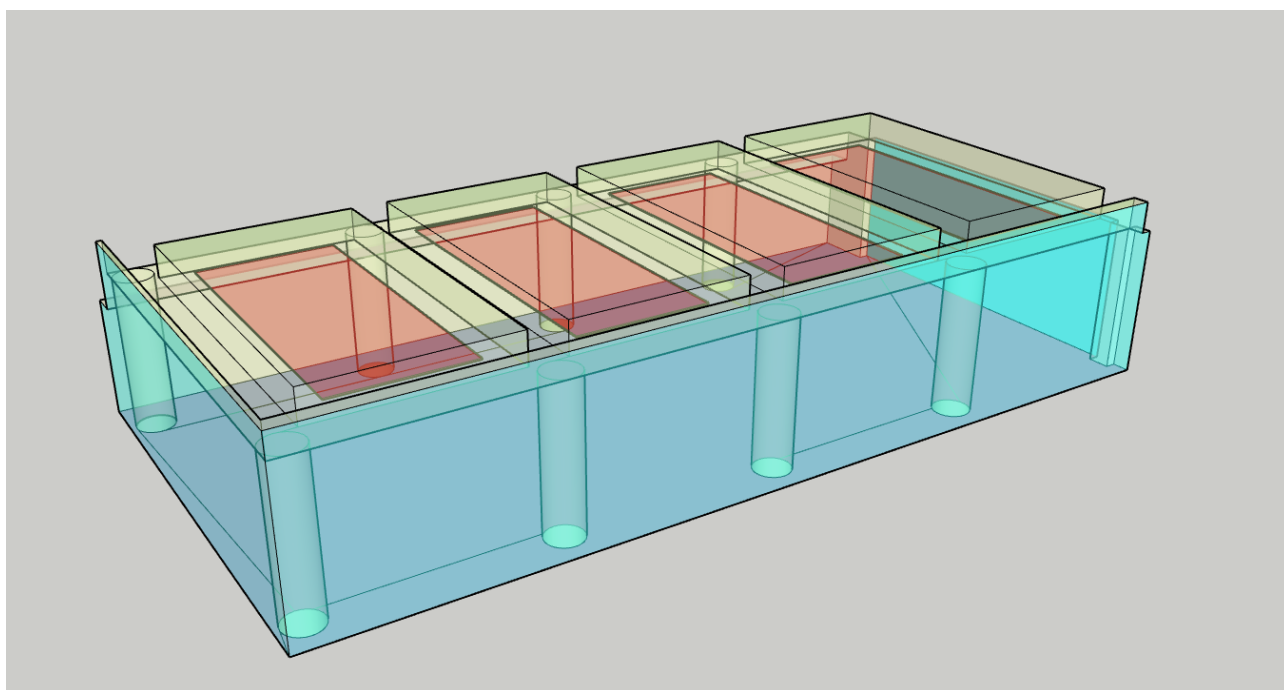


Figure 1 3D screenshot of the Main Events Space geometrical model

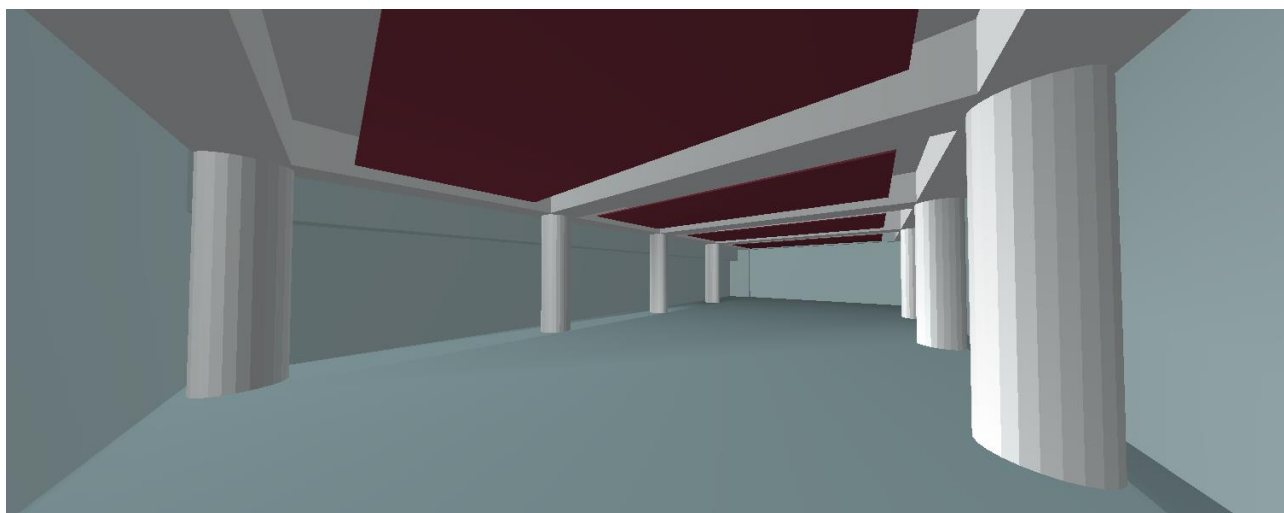


Figure 2 Screenshot of the Main Events Space acoustic model

The following finishes have been used for the modelling:

Area	Acoustic finish properties
Floor	Hard and reflective
Walls – Solid walls / glazed screens	Hard and reflective
Existing soffit	Hard and reflective
Existing column linings and ceiling beams	Hard and reflective
Perforated metal tiles (per “raft”)	65% of tiles (approx. 14no.) provided with an acoustic backing enabling them to achieve Class A absorption performance ($\alpha_w \geq 0.9$) 35% of tiles (approx. 7no.) provided with acoustically transparent visual backing only, or nothing.

The results of the modelling exercise indicate compliance with the recommended project criteria would be achieved on the basis of the above strategy. Class A absorption is not considered to be an onerous performance to achieve from perforated metal panels with acoustic backing, subject to a sufficient free area being provided through the perforations.

It is recommended that tiles with acoustic backing be distributed as evenly as possible across each “raft”.

Careful consideration to the design of AV systems to assist amplified speech / presentations within the space is still recommended to minimise unwanted reflections and retain speech intelligibility across the full depth of the room during presentations, although it should be noted this falls outside of the current scope of Hoare Lea appointment.

2.3 Building services considerations.

2.3.1 Building services noise contributions.

It is recommended that building services noise contributions within this space be controlled so as not to exceed NR 35, to enable a suitable listening and concentration environment within the event space.

This noise level is higher than would be ideal for formal presentation type spaces, but is considered pragmatic given the design constraints of incorporating new comfort cooling units within the room while retaining the existing building services.

It is recommended that due consideration to the number of new indoor air conditioning units be given when specifying these, to ensure the recommended overall building services noise rating is not exceeded by the new items of plant installed as part of the refurbishment works. Based on the currently proposed 8no. air conditioning units within the room, it is recommended that each unit be specified to comply with NR 25.

A further review of the building services scheme should be carried out as the design matures during the next design stage.

2.3.2 Crosstalk attenuation.

An allowance should also be made for the provision of cross-talk control within the existing fresh air supply plenum serving the existing Reception Area, which is proposed to be retained and serve both the events space and the new entrance space, to ensure impact of the sound insulation performance of the separating wall is limited. A similar allowance would be required for the air transfer grille proposed directly between the main events space and the reception space.

It is understood 1200mm long Alloway attenuators achieving the insertion losses provided in Table 1 are proposed. These would be suitable to control crosstalk between the two spaces at both locations.

Table 1 Alloway crosstalk attenuator insertion loss data

Octave band centre-frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Static insertion loss (dB)	7	12	20	28	35	28	23	14

3. Main Engagement Space.

A new engagement space is proposed within the Cellar floor to house visiting school groups and enable educational activities.

3.1 Internal sound insulation.

Acoustically rated doorsets / sliding screens capable of achieving a minimum sound insulation performance of **R_w 30 dB** are recommended to control noise break-out from the AHU unit proposed to be located within one of the adjacent secondary spaces.

A new separating drywall is proposed on both sides of the AHU unit to enclose it from adjacent proposed toilet and engagement space secondary space uses. At this stage it is recommended that this wall be specified to achieve a minimum sound insulation performance of **R_w 47 dB**.

Careful consideration of the detailing of the proposed new-build elements with the existing structure and any listed elements will be required as the detailed design develops.

3.2 Reverberation control.

It is understood the restrictive heritage constraints applicable to this room severely restrict the scope of any formal acoustic finishes strategies.

To improve acoustic comfort and minimise reverberant noise build-up during visits, provision of soft finishes is recommended within this space if at all possible. This could include soft covers to the floor and soft furnishings across the room.

Sound absorbent treatment could be incorporated into the proposed new separating screens to avoid obscuring existing brickwork.

Detailed considerations of sound absorbent finishes will be progressed as finishes proposals evolve.

3.3 Building services considerations.

It is recommended that building services noise contributions within this space be controlled so as not to exceed NR 35, to enable a suitable listening environment within the event space. This is dependent on feasibility of coordination with existing AHU serving the current space.

Suitable allowance for attenuators should also be made to control building services noise from the proposed AHU, as well as cross-talk transfer between the main engagement area room and neighbouring uses along the proposed duct routes.

4. Virtual teaching suite.

A new virtual teaching space is proposed within the historical building to enable educational activities to be broadcast to a wide remote audience.

4.1 Reverberation control.

It is understood the restrictive heritage constraints applicable to this room severely restrict the scope of any formal acoustic finishes strategies.

It should be noted however, that the acoustic quality of the space will be critical to ensuring adequate room acoustic conditions are provided for the intended video conferencing uses of the space, even if no detailed technical video conferencing requirements are understood to apply to date.

It is understood the current room is predominantly hard and reflective, with little absorption in the existing space. An allowance for soft finishes within the room should be considered generally such as floor carpets and upholstered furnishings where possible, to provide some amount of absorption control with minimum intrusion in the space finishes.

Deployable curtains ($> 500\text{g/m}^2$) were previously recommended in addition to the above to provide cover to at least 2 non-parallel walls, inclusive of the wall facing the proposed screen location, but it is now understood this element may not be possible to integrate within the proposed scope of works. Even if this were to be reduced to a deployable element along one wall of the room, it is anticipated it would provide a noticeable improvement on the acoustics of the space.

4.2 Building services considerations.

It is recommended that building services noise contributions within this space be controlled so as not to exceed NR 30, to provide a reasonably low level of background noise for recording and broadcast activities proposed within this room.

A new air conditioning unit is proposed to serve this room, encapsulated within a new-build enclosure on the Atrium wall. The boxing-in element to this unit is currently noted to comprise heritage panelling, which is assumed to comprise some form of solid imperforate timber panels to mimic the existing room finishes, **although this should be confirmed.**

At this stage it is recommended that an allowance be made to incorporate at least 1 layer of 12.5mm dense plasterboard such as SoundBloc or equivalent to the rear of the heritage panels with mineral fibre incorporated within the cavity as a robust solution to control casing noise break-out from the unit, subject to final unit selections and a review of the proposed boxing-in solution proposed.

5. Rooftop building services plant noise control.

5.1 External plant noise egress.

5.1.1 Plant noise limits.

The cumulative maximum sound pressure levels for fixed plant, equipment and machinery associated with the development shall not exceed the levels presented in Table 2 at 1 m from the nearest noise sensitive premises. The results of a noise survey carried out on site and plant noise limits set on the basis of these are reported separately in Hoare Lea planning report *REP-1014369-5A-LR-20230428-Acoustic planning report-Rev00*, dated 28/04/2023.

All noise generating plant and equipment associated with the development will be designed to ensure that the noise egress limits specified above are achieved.

Table 2 Maximum permissible sound pressure levels at 1m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1m from the nearest noise sensitive premises ($L_{A_{r,T}}$ dB) ^[1]
07:00 to 23:00 hours	38
23:00 to 07:00 hours	37

Note [1] - If plant noise contains any tonal or impulsive characteristics, a further correction shall be applied to the levels set out above in accordance with BS 4142:2014.

5.1.2 Initial plant noise assessment.

The results of an assessment of the proposed rooftop building services plant scheme show that a noise mitigation strategy shall be required in order to comply with the limits set in Table 2. These shall include, but not be limited to, the measures set out in Table 3.

A marked-up combined services layout is provided at the end of this note to illustrate the required extent of the solid screen recommended below is presented in Figure 1.

Table 3 Proposed mitigation strategy measures for rooftop plant noise control

Plant item	Mitigation steps recommended
AHU01 & AHU02 atmospheric terminations	In-duct attenuation to be provided to all atmospheric terminations ensuring each termination does not exceed L_w 65 dB at the termination grille.
AHU01 & AHU02 casing break-out ^[1] All outdoor VRF units	Solid screening is recommended behind the proposed visual screening louvre proposed to the northern perimeter of the proposed rooftop plant area, to provide a solid imperforate barrier between the proposed and existing building services scheme and the nearest residences across Wood Street. The screen should achieve a minimum surface weight of 15kg/m ² and extend to the full height of the visual screening louvre enclosing the rooftop plant area.

Note [1] – No casing break-out noise is currently available for the proposed AHUs, this element should be reviewed as the design matures to ensure any additional mitigation measures required are incorporated into the final building services scheme.

The above measures are shown to result in a cumulative plant noise contribution of L_{Aeq} 37 dB at the front windows of the top residential flats directly across Wood Street from the proposed site, which complies with the limits set.

A final plant noise assessment should be carried out once final plant noise selections have been made to ensure the plant noise limits set are met.

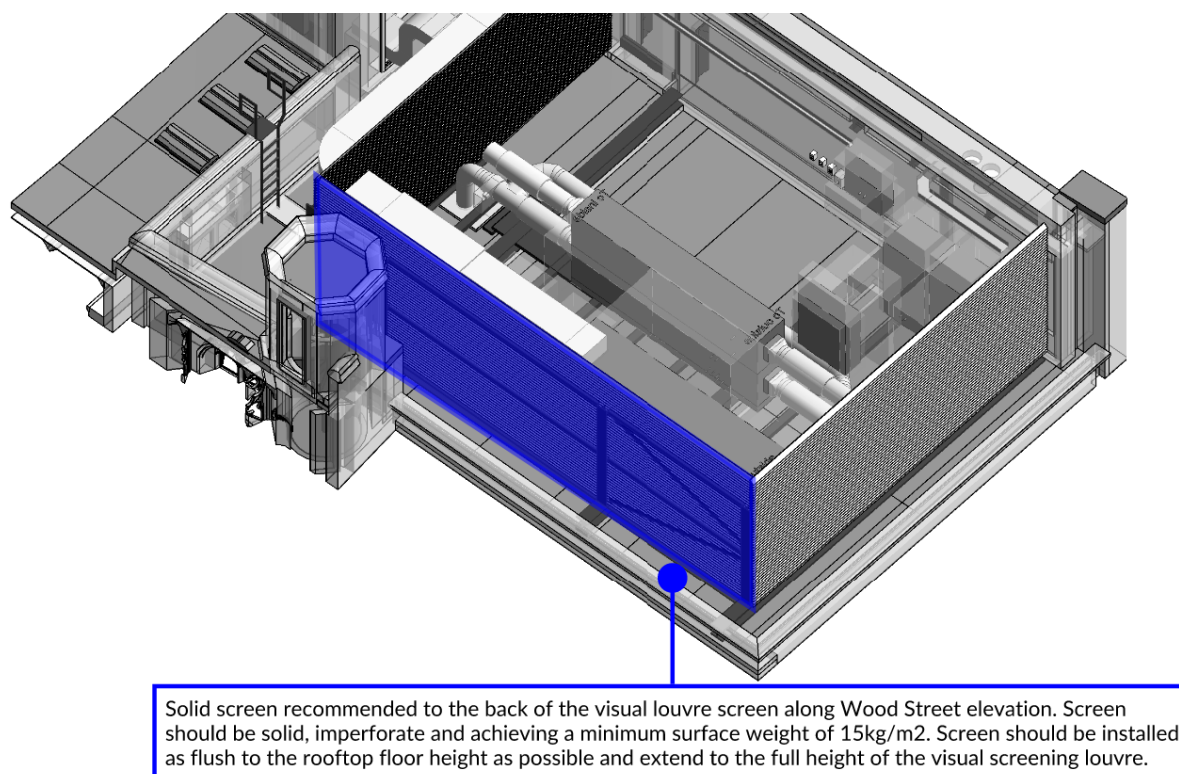


Figure 3 Marked-up extract of combined services layout drawing 0406115-HLEA-ZZ-50A-D60-CS-30-01

5.2 Rooftop plant noise break-in to occupied areas below.

Where ductwork routes drop directly from the rooftop plant area to the third floor, there is a risk that rooftop plant area noise could transfer down into the occupied spaces below.

As such, it is recommended that an allowance be made at this stage to provide a minimum of 25mm external acoustic lagging (comprising an internal mass element with surface weight of 5kg/m²). The identified routes where this occurs are shown in Figure 4. The external lagging should extend from the primary AHU-side attenuator to the point of penetration through the rooftop slab.

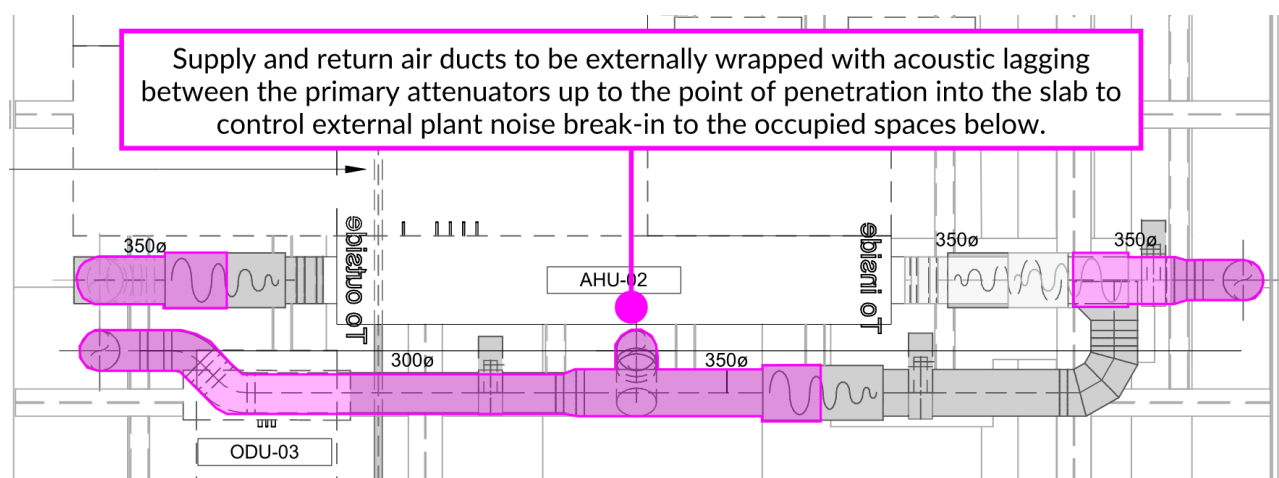


Figure 4 Marked-up extract of combined services layout drawing 0406115-HLEA-ZZ-50A-D60-CS-30-01