SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Plant assessment, 82 King Street

Acoustic testing and plant room noise guidance

Summary

As detailed in Sandy Brown 025877-R01-A *Noise survey and plant noise egress limits report* (dated 16 April 2025), to control plant noise egress to surrounding sensitive receptors, plant noise breakout from louvres is required to be limited to a sound power level of L_{wA} 65 dB (per facade).

Based on this limit at the louvre, cumulative noise limits for plant items have been predicted as follows based on standard, non-acoustic louvres:

- Cumulative plant limit without sound absorbent treatment NR47
- Cumulative plant limit with 50 mm mineral fibre soffit: NR50

These limits are likely to be onerous for typical VRF/ASHP units depending on the number and duty of the proposed units. This will need to be reviewed once indicative selections are available.

The inclusion of a 300 mm depth acoustic louvre to the proposed louvre area has also been investigated to allow for higher noise levels in the plant room. This is expected to allow for the following limits within the room:

- Cumulative plant limit without sound absorbent treatment: NR62
- Cumulative plant limit with 50 mm mineral fibre soffit: NR65

These limits are more representative for typical VRF/ASHP units depending on the number of units, and proposals will need to be reviewed when available. As such, it is recommended that acoustic louvres are provided to the plant room.

Based on the measured sound insulation performance of the existing floors, and the sound power limits listed above, airborne noise transfer to above and below is expected to be suitably controlled.

To control noise transfer between the plant room and other spaces on Level 2, a minimum 300 mm thick partition with minimum laboratory sound insulation performance of $R_w + C_{tr}$ 55 dB is recommended. A soffit lining in the plant room or bulkhead detail will likely be required to control flanking transmission via the existing slab above the new plant room wall.

Example constructions are given within this memo which are capable of achieving the recommended standards.

Proposal

A new plant room is proposed to be located at level 2 to provide temperature control for the offices, and assumed to be normally operating during the day, with a setback mode at night and weekend operation. The location of the new plant room is shown in Figure 1

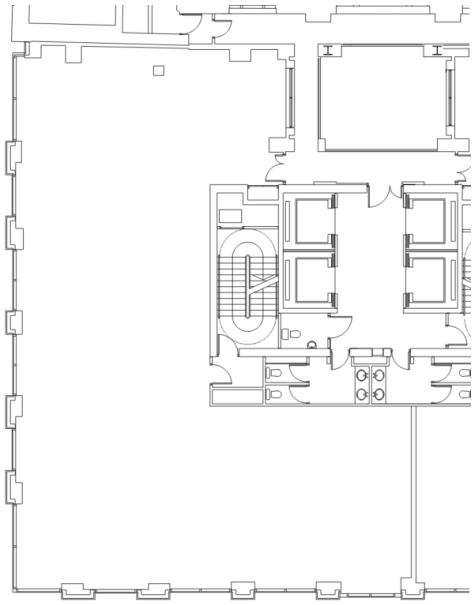


Figure 1 Level 2 proposed plant location

An internal single glazed system is installed between the proposed plant room and the adjacent walk way as shown in Figure 2. Comments on the shown arrangements have been provided within this memo.



Figure 2 Existing room front for the proposed plant room

Site details

The proposed plant room is currently a vacant office space comprising open plan and cellular spaces. A photograph showing the existing Level 2 office space where the plant is proposed is provided in Figure 3.

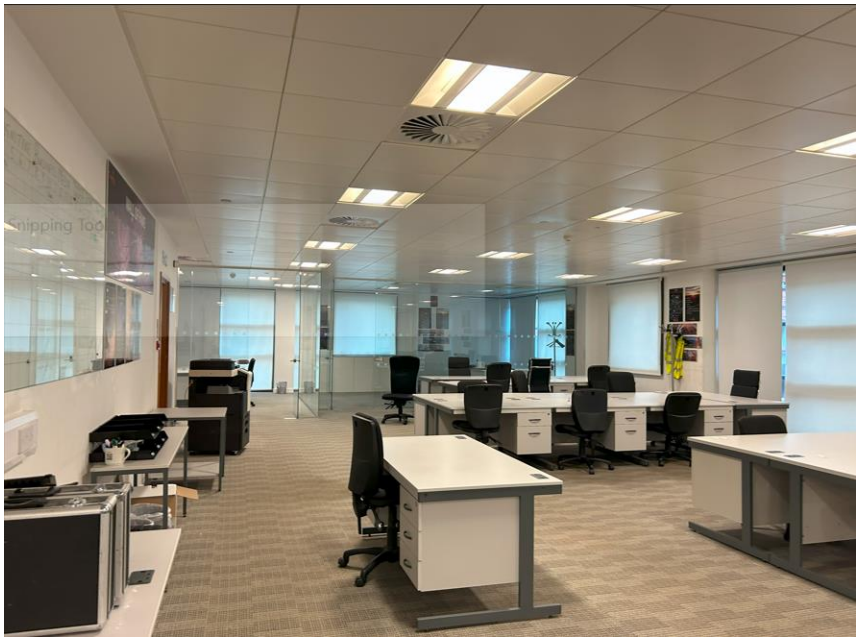


Figure 3 Level 2 existing office space where the plant room is proposed

The existing finishes include:

- carpet floor,
- plasterboard and glazed internal partitions,
- suspended grid tile ceiling system.

On Level 3, there are cellular spaces with similar finishes to the vacant office on Level 2.

On Level 1, there is a commercial unit, comprising Vella Studios hair salon, and other circulation spaces.

Sound insulation testing

Airborne sound insulation testing has been carried out to the existing floors above and below the proposed plant room. Sample noise measurements were also carried on in the adjacent spaces. The detailed methodology & equipment used for the testing is provided at the end of the memo.

The locations of the tests were limited by access to rooms during the testing. Mark-ups of the tests carried out are shown in Figure 4 to Figure 6.

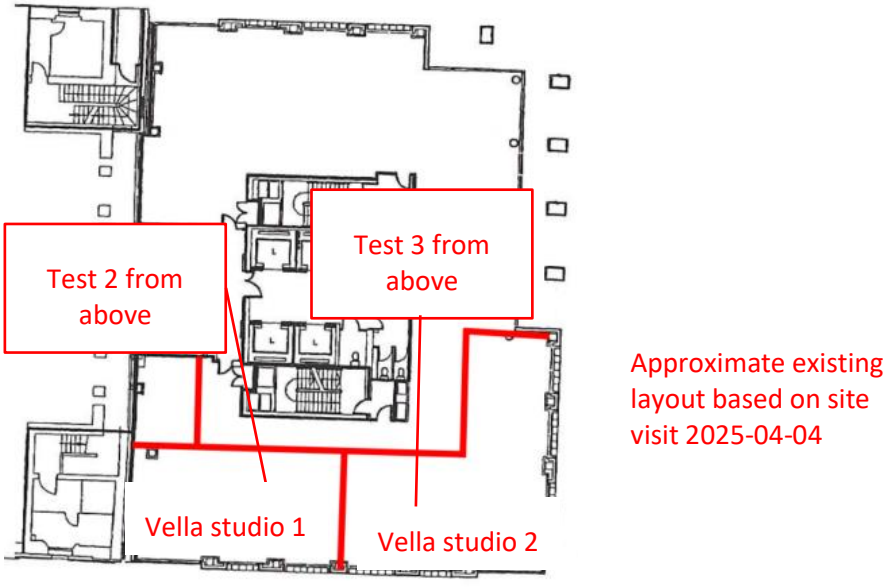
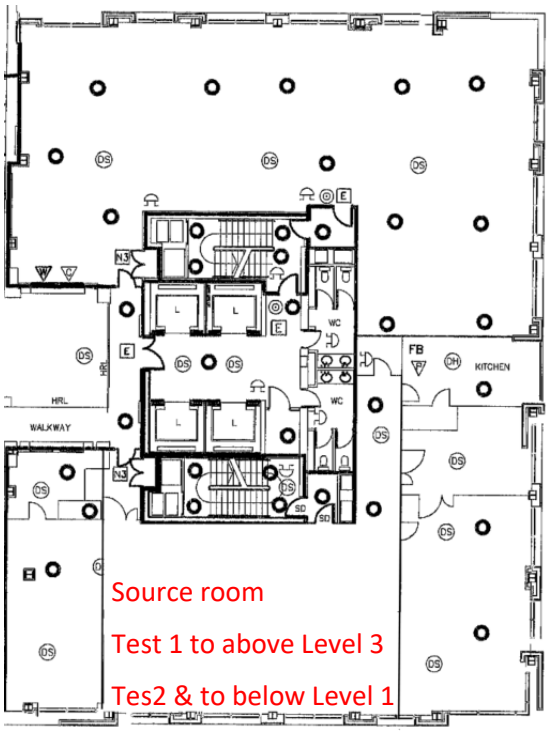


Figure 4 Test locations Level 1



Approximate existing layout based on site visit 2025-04-04

Figure 5 Test locations level 2

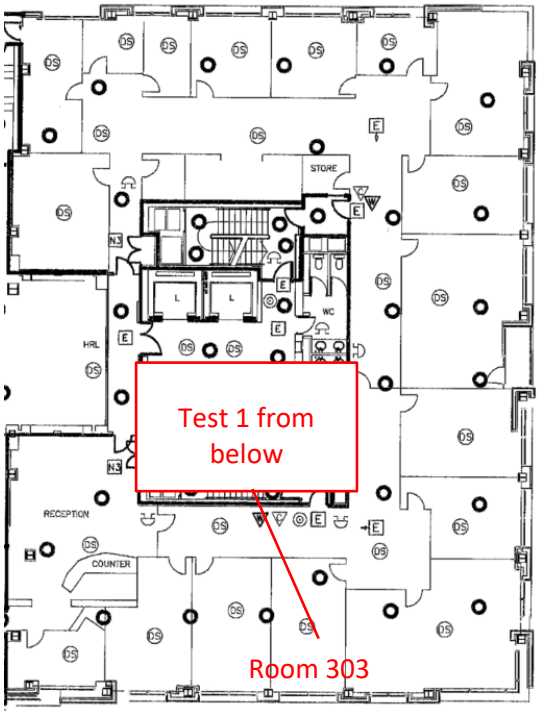


Figure 6 Test location Level 3

Results

Floor airborne sound insulation

The measured airborne sound insulation performances for the tested floors are summarised in Table 1.

Table 1 Measured floor airborne sound insulation test results

Test ref	Source room	Receiver room	Testing result, $D_{nT,w}$ (dB)
1	Level 2 office	Level 3 room 303	57
2	Level 2 office	Level 1 Vella studio 1	52
3	Level 2 office	Level 1 Vella studio 2	57

The tested floors include the existing suspended grid ceiling and raised access floor. If the suspended ceiling and/or raised access floor are stripped out, the airborne sound insulation performance is expected to have an overall floor reduction in the region of 5 dB when compared to the test results summarised in Table 1 which has been factored into the assessment.

The airborne sound insulation test result for test reference 2 is considered the worst-case scenario. All measurements were limited to various extents by background noise levels. As such, the true existing performances are expected to be slightly higher than those presented above, though this cannot be quantified.

Internal ambient noise levels

The measured internal ambient noise levels are summarised in Table 2. Conditions during test ref 1 and 3 were dominated by environmental noise ingress, while test ref 2 was dominated by building services in operation.

Table 2 Measured internal ambient noise levels

			Measured sound pressure level
Test ref	Room	NR (L_{eq}, dB)	L_{Aeq} (dB)
1	Level 3 room 303	28	34
2	Level 1 Vella studio 1	40	43
3	Level 1 Vella studio 2	32	37

Plant noise limits

Environmental noise egress

The proposed plant room is located on Level 2 of the 82 King Street tower. It is assumed that flush louvres will be installed to the full extent of the west elevation (Essex Street) and part of the south elevation (facing Tib Lane). These are highlighted in red in Figure 7 and Figure 8.

The exact allowance for louvres should be confirmed.

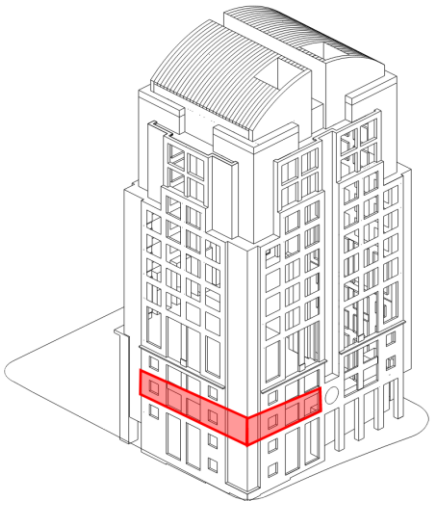


Figure 7 Louvre installation elevation mark-up

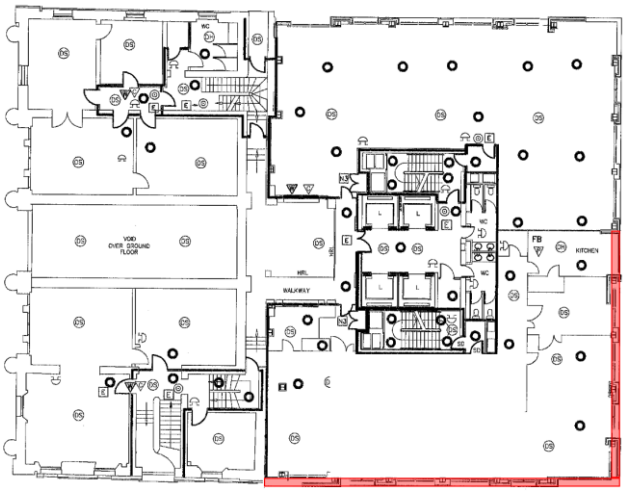


Figure 8 Louvre installation general arrangement mark-up

At this stage, further details of the plant proposals are not available.

Limits at the louvre

In line with the environmental noise measurement results set out in 025877-R01-A *Noise survey and plant noise egress limits report* dated 16 April 2025, the plant noise egress limits at 1 m from the nearest noise sensitive premises are set out in Table 3.

Table 3 Plant noise limits at 1m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Day (07:00-23:00)	47
Night (23:00-07:00)	46

[1] The limits set out above do not include any attention catching features. Penalty corrections for attention catching features may be significant and will need to be considered as the building services design progresses.

Compliance with limits shall be determined with reference to BS 7445: Part 3: 1991 *Description and measurement of environmental noise, Part 3. Guide to application to noise limits*.

To achieve the Local Authority criteria at the nearest noise sensitive receiver during the day, the louvres are required to achieve a sound power level of L_{wA} 65 dB. A 1 dB setback in duty would be required to meet the night-time noise egress limits.

The limits are set out on the basis that the typical ASHPs contain no attention catching characteristics such as tonality or intermittency, as these would incur penalties to the rating level based on BS 4142:2014+A1:2019.

Internal plant limits

The worst-case floor airborne sound insulation measurement result (test ref 2), the cumulative plant noise limits within the plant room have been set out to ensure:

- noise transfer via the floor are suitably controlled to the spaces below and above
- noise egress via the proposed louvres are suitably controlled to achieve a sound power level of L_{wA} 65 dB set out to meet the Local Authority criteria at the nearest noise sensitive receiver (during the day operation).

Typically, items of plant are large and require a greater floor to ceiling height when compared to typical office spaces. On this basis and to account for a worst-case assessment, it has been assumed that the existing raised access floor and suspended grid ceiling in the proposed plant room will be removed. Plant limits have been set out based on the measurement results for the existing floor with a correction for the existing floor to the Vella studio below.

Based on the indicated plant louvre extent in Figure 7 and Figure 8 with standard non-acoustic louvres, the cumulative sound power limits for the plant in the room are set out in Table 4.

A greater extent of sound absorbent treatment within the room would allow the louvre limits to be met with louder plant items, as the treatment will reduce the noise build-up within the room. As such, plant sound power limits are presented below for two typical treatment conditions:

- No treatment
- 50 mm mineral fibre (typically fleece faced with a perforated metal covering) to an area equal to the full extent of the soffit.

Table 4 Cumulative day time plant noise limits

		Cumulative plant sound power level limits, L_w (dB) Octave-band centre frequency (Hz)							
Day operation	L_{wA}	63	125	250	500	1000	2000	4000	8000
Plant room	67	66	72	67	62	60	59	58	57
No treatment									
Plant room	69	69	74	69	64	62	60	60	59
50 mm mineral fibre to full soffit extent									

These correspond to the following NR limits in the plant room which are considered overly onerous:

- Plant room no treatment – NR47
- Plant room with treatment – NR50

In order to meet the night-time limits, plant noise levels should be reduced by 1 dBA from the above limits, likely using a setback in duty.

The above limits are considered onerous for a typical ASHP/VRF system with the cooling/heating capacity required to serve the full tower.

Depending on the number of plant items and their sound levels, mitigation measures are likely to be required, as outlined below:

- Selection of units with low noise levels
- Acoustic attenuation packages
- Acoustic louvres to the facade
- Ducted/attenuated connections to the louvres to provide air to and from the plant room with the remaining louvre closed off.
- Sound absorbent treatment within the plant room
- A combination of the above

Use of acoustic louvres to the plant room has been investigated to allow for higher noise limits within the room (more typical of ASHP/VRF levels). On the basis that an acoustic louvre with minimum insertion loss set out in Table 5 is provided, maximum plan noise limits have been set out in Table 6.

Table 5 Acoustic louvre minimum sound insulation

	Acoustic louvre minimum sound transmission loss, (STL)(dB) Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Acoustic louvre (approximately 300 mm depth)	5	5	8	12	19	19	15	14

Table 6 Cumulative day time plant noise limits with acoustic louvre

		Cumulative plant sound power level limits, L_w (dB) Octave-band centre frequency (Hz)							
Day operation	L_{wA}	63	125	250	500	1000	2000	4000	8000
Plant room No treatment	81	71	76	74	73	75	76	71	69
Plant room 50 mm mineral fibre to full soffit extent	84	76	80	78	77	79	78	73	71

These correspond to the following NR limits in the plant room which are expected to be more practically achievable.

- Plant room no treatment – NR62
- Plant room with treatment – NR65

As such, acoustic louvres are recommended to the plant room.

A 1 dB night-time setback duty would be required to meet the night-time limits at the nearest noise sensitive premises.

Guidance on sound insulation to control noise transfer within the building

Floor

On the basis that the overall plant sound power levels set out above are met, the predicted noise levels in the cellular spaces directly above and below are expected to be ≤ NR 20. This is considered suitable with some allowance for increase if breakout from the louvres can be further mitigated to allow for higher noise levels in the room (as discussed above).

Partition

Plant room to office space

Due to time constraints during the site visit, this wall was not fully inspected, however did not appear to have visible unsealed opening below the suspended ceiling. The measured wall thickness in the floor layout between the proposed plant room and office is 200 mm.

Noise transfer to the adjacent office demises on Level 2 needs to be controlled. The minimum required on-site sound insulation performance for the partition (including any flanking paths) are set out in Table 7. The laboratory requirements are provided with a lab-to-site tolerance of 10 dB overall. A minimum 300 mm drywall thickness is recommended to control low frequency noise transfer.

Table 7 Partition minimum sound insulation performance

On-site performance	Laboratory performance	Example build-up
$D_w + C_{tr}$ 45 dB	$R_w + C_{tr}$ 55 dB	Slab-to-slab 3 x 15 mm high density plasterboard (≥840kg/m^3) to both sides of twin 90 mm metal C-studs with 2 x 50 mm mineral fibre insulation in cavity (overall width 300 mm) following the principles shown in Figure 9

Alternatively, enhancements to the existing office partition would be suitable option from an acoustic perspective. The measured existing drywall thickness is (200 mm). To control low frequency noise to the adjacent office space. It is recommended that a provision for an independent lining be allowed for. An example of acoustic drywall lining build-up is provided below, however this will need to be confirmed once the existing partition build-up is provided or tested.

- 2 x 15 mm SoundBloc to one side of Gypframe 70 'I' stud with minimum cavity of 150 mm with 50 mm mineral fibre insulation

Plant room to circulation

The plant room front is adjacent to the circulation/walkway on level 2, this is open to the ground floor circulation hall via a well. In addition, the plant room is adjacent to a WC on level 2.

For the purpose of the assessment and to control plant noise transfer to the circulation and WC minimum overall sound insulation performances have been set out in Table 8.

A minimum 200 mm drywall thickness is recommended to control low frequency noise transfer to room front.

Table 8 Partition minimum sound insulation performance

Minimum on-site performance	Minimum laboratory performance	Example build-up
Plant room to circulation/walkway		
$D_{nT,w}$ +C_{tr} 40 dB	R_w +C_{tr} 50 dB	2 x 15 mm of Gyproc SoundBloc to both sides of of Gypframe 146 S 50 'C' studs with 50 mm (mineral fibre insulation) in the cavity
Plant room to WC		
$D_{nT,w}$ +C_{tr} 35 dB	R_w +C_{tr} 45 dB	3 x 12.5 mm of Gyproc SoundBloc to both sides of of Gypframe 146 S 50 'C' studs with 50 mm (mineral fibre insulation) in the cavity

The overall sound insulation performance of the existing room front is not known, however a (5-8 mm) single glazed element with metal frame is installed within a 145 mm thick drywall partition. In addition, a large area of the existing room front door is also single glazing as shown in Figure 2.

Based on the existing arrangements, the room front is not expected to be capable of achieving the overall sound insulation performance set out in Table 8. One of the following options should be considered as the design progresses:

- Option 1: Replace the existing wall/glazing with a new drywall partition (example build-up has been provided in Table 8)
- Option 2: Remove the glazing elements, build the wall as per existing build-up, and provide an infill of 2 x 15 mm sound rated boarding, with the following enhancement to existing wall, example provided below
    - 2 x 15 mm SoundBloc to one side of Gypframe 70 'I' stud with minimum cavity of 90 mm with 50 mm mineral fibre insulation to plant room side

Plant room to WCs

Based on the received layouts, a drywall partition thickness of approximately 98 mm is indicated between the proposed plant room and existing WCs. This partition thickness is not

expected to be capable of achieving the required on-site performance. On this basis, one of the following two options should be considered:

- Option 1: Replace the existing wall with a new partition (example build-up has been provided in Table 8)
- Option 2: Enhance the existing partition with an independent wall lining to plant room side as set out for the room front

The existing partition build-ups/sound insulation performance will need to be reviewed/ tested to ensure the on-site sound insulation performances are met.

Plant room to staircase

The overall sound insulation performance of the stair core is not known, however based on the received layouts, the partition thickness is 297 mm, on the basis of this core wall being solid masonry and well-sealed, this wall is likely to be capable of achieving a minimum sound insulation performance in the region of R_w+C_{tr} 50 dB. On this basis, it would be considered suitable to control plant room noise to the stair.

Interface detailing with floors

The exact construction of the existing floor slab is not known. There is a risk of excessive horizontal flanking transmission occurring with if the slab has less mass than 150 mm solid normal weight concrete (350 kg/m^2). If this is the case, a soffit lining comprising 2 x 12.5 mm dense plasterboard with minimum void of 150 mm containing 50 mm mineral fibre insulation in the cavity should be added to the plant room to control horizontal flanking via the slab. Alternatively, a bulkhead detail spanning at least 500 mm comprising the same lining construction could be provided to both sides of the wall.

Guidance on head interface detailing is also provided below.

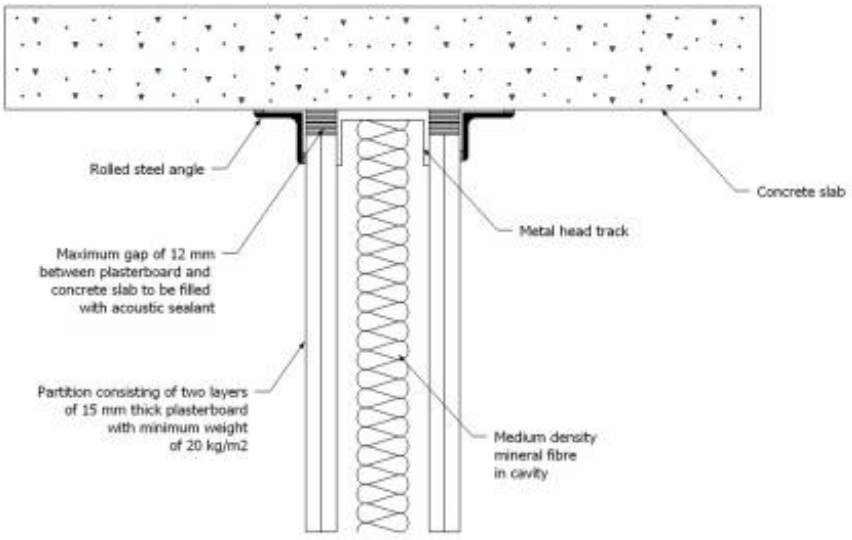


Figure 9 Sketch head detail- drywall with flat concrete slab soffit

If soffit is concrete on profile deck, all gaps should be suitably sealed following the principles shown in Figure 10 or Figure 11.

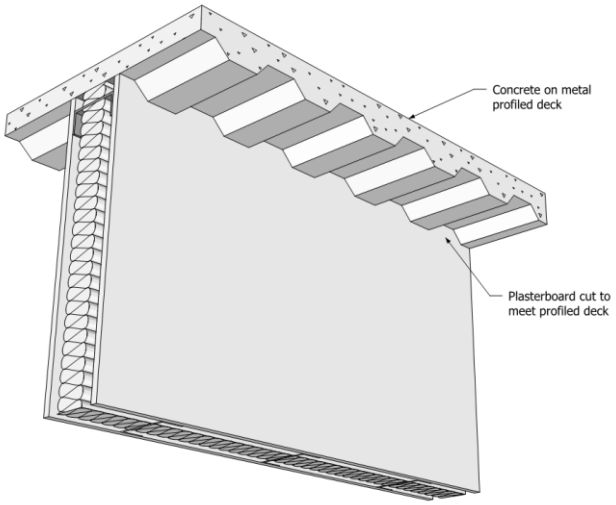


Figure 10 Sketch head detail - drywall with trapezoidal deck (not for construction)

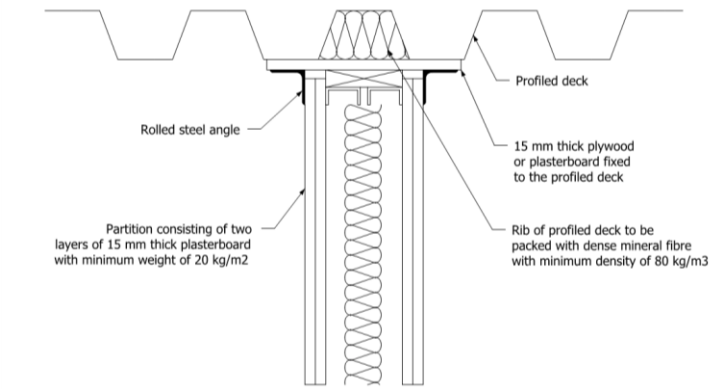


Figure 11 Sketch head detail - drywall with parallel trapezoidal deck (not for construction)

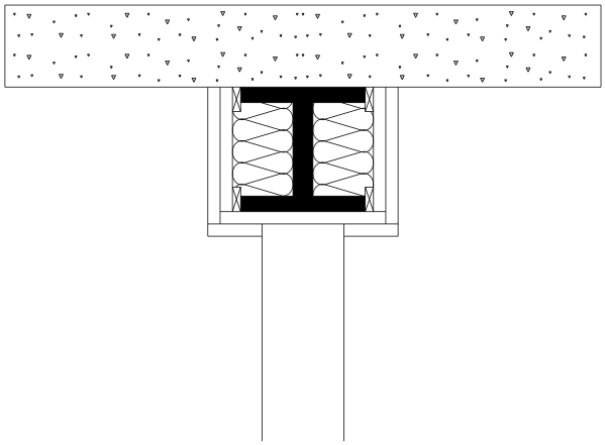


Figure 12 Sketch head detail – partition meeting steel beam (not for construction)

Interface detailing with existing walls

On the basis that the existing wall between the tower and the bank building comprises a well-sealed medium density solid masonry wall of >300 mm, the existing constructions would likely be suitable for controlling plant noise transfer. However, at this stage an independent plasterboard wall lining should be allowed for depending on the state of the existing wall.

Internal plasterboard linings will need to be discontinuous across the new separating partition and floor interfaces with the facade. Dense mineral fibre cavity stops may be required along the partition and floor lines subject to design development.

Figure 13 shows the principles of a discontinuous drywall interface with internal wall lining and cavity stop.

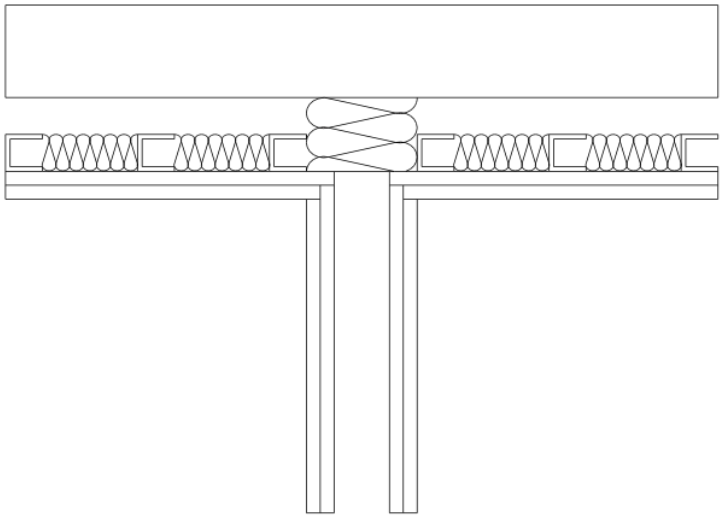


Figure 13 Sketch detail- plasterboard partition abutting facade internal lining (not for construction)

Interface detailing with columns and beams

During the site visit and testing, the columns were boxed-in with plasterboard and it is likely that mineral fibre insulation was installed within the cavity.

If any of the column linings are proposed to be striped out, this will need to be retained lined as per tested or boxed-in

The received layouts indicate that columns and beams are steel work with plasterboard linings to the room side. On this basis, all steel columns with the plant room should be independently lined with:

- 2 x 12.5 mm dense plasterboard (840 kg/m^3 or equivalent) with 25 mm mineral fibre insulation (16 kg/m^3)

Sketch showing the principles of steel beam head interface detail is shown in Figure 12, A sketch showing the principle of partition interface detail with a steel beam/ column is shown in Figure 14.

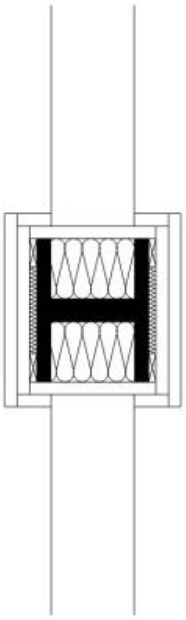


Figure 14 Sketch detail- plasterboard partition abutting steel beam/column (not for construction)

Door sound insulation

There is a double leaf metal door with a large glazing area to the plant room front as shown in Figure 2, this is adjacent to a circulation space which is opened to the level below the bank building via an atrium.

It is recommended that a lobbied door arrangement with doors selected to provide a minimum sound insulation performance of R_w 35 dB be provided to the plant room control noise break out via the doors.

Control of structure-borne noise and vibration

Vibration associated with the building services should be suitably controlled such that do not cause:

- disturbance in terms of perceptibility
- the maximum noise criteria to be exceeded in terms of structure-borne noise.

All mechanical plant and equipment should be appropriately isolated. such that it does not:

- Exceed a Vibration Dose Value (VDV) of 0.4 $m/s^{-1.75}$ as given in BS 6472-1: 2008 in all other occupiable spaces
- be of a magnitude which causes the internal noise criteria to be exceeded
- be of a magnitude which causes the vibration criteria for specific equipment to be exceeded.

In addition, vibration transfer from plant to occupied areas shall not exceed 0.01 m/s^2 peak acceleration, based on W_b weighting as defined in clause 3.3 of BS 6472-1: 2008.

Conventional measures such as anti-vibration mounts, resilient hangers and flexible connections should be provided to all vibration producing equipment.

Test methodology and equipment details

Airborne sound insulation

Airborne sound insulation was measured in general accordance with the procedure set out in BS EN ISO 16283-1:2014 *Acoustics - Field measurements of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation.*

All windows and doors in the source and receiver spaces were closed during the measurements.

Broadband continuous steady pink noise was generated at a constant level in the chosen source room. It was ensured that sound from the loudspeaker was not directly incident on the separating partition being tested.

Each measurement was time-averaged over a 30-second period. The measured noise levels were obtained in one-third octave bands from 50 Hz to 10 kHz inclusive, from which the Weighted Level Difference (D_w) and the Standardised Weighted Level Difference ($D_{nT,w}$) were then was assessed.

noise levels were obtained in one-third octave bands from 50 Hz to 10 kHz inclusive.

Reverberation time

Reverberation times in the receiving rooms were measured in general accordance with BS EN ISO 3382-2:2008 using the interrupted sound method with a loudspeaker as the sound source.

At least six measurements were made in each receiving room using three microphone positions and one loudspeaker position. Two measurements were made at each microphone position.

Equipment

Calibration details for the equipment used to carry out the acoustic measurements are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	XL3/ A3A-01221-F0	NTi	2 Dec 26	UCRT24/2613ATR UCRT24/2615
Microphone	MC230A/A28047	NTi	2 Dec 26	UCRT24/2613ATR
Pre-amp	MA220-230/14610	NTi	2 Dec 26	UCRT24/2613ATR
Calibrator	SV30A/10567	Svantek	20 Sep 26	UCRT24/2251
Loudspeaker	CP8	QSC	N/A	N/A
Noise source	MR1	Neutrik	N/A	N/A

Calibration of the meter used for the measurements is traceable to national standards. Calibration certificates for the sound level meter used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the acoustic measurements. No significant calibration deviation occurred.