

Noise and Acoustic Advice

Laystall St, Manchester

Reference: 9060/BL



Document Control				
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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustics or vibration aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

RGB Group appointed Acoustic Consultants Limited to provide noise and acoustic advice for the proposed residential accommodation at Laystall St, Manchester. The development comprises of a change of use from apartments to rooms for residential purposes.

The development is to be designed to meet the requirements of Approved Document E along with the Marriot Hotel Brand Standards. This report provides comment and advice on the external noise climate, internal separating and flanking element constructions, room acoustics and building services noise.

The Ground floor Layout plan and indicative upper floor plan are provided below:

Figure 1: Ground Floor Plan

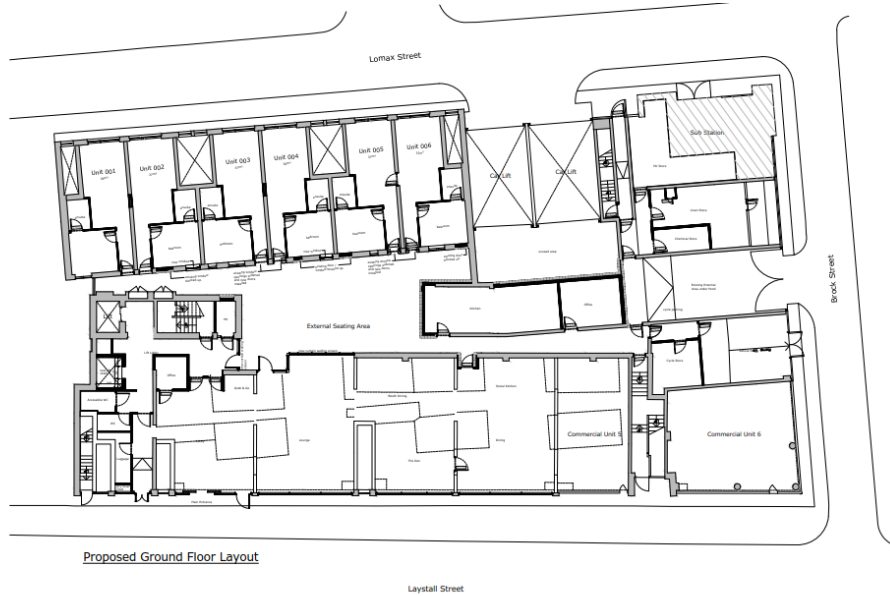


Figure 2: 1st – 4th Floor Plan

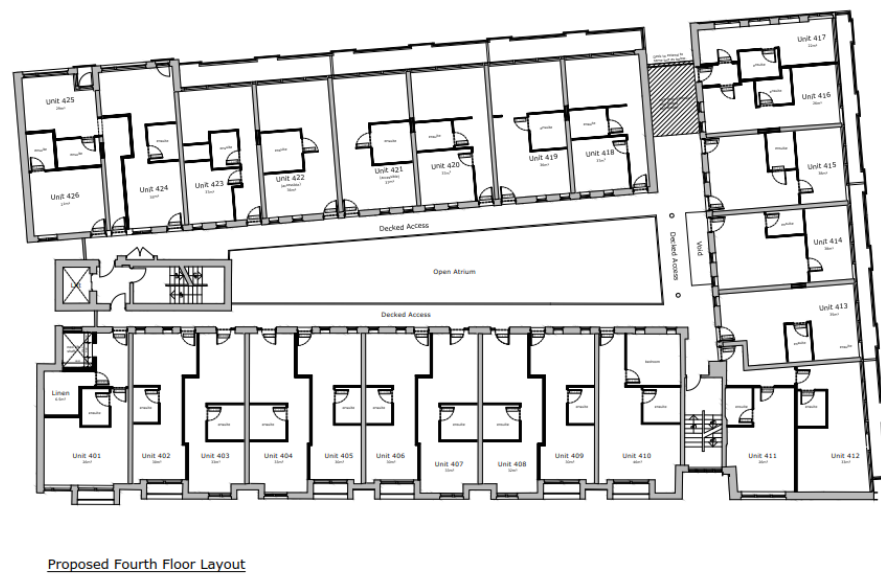


Figure 3: 5th – 6th Floor Plan

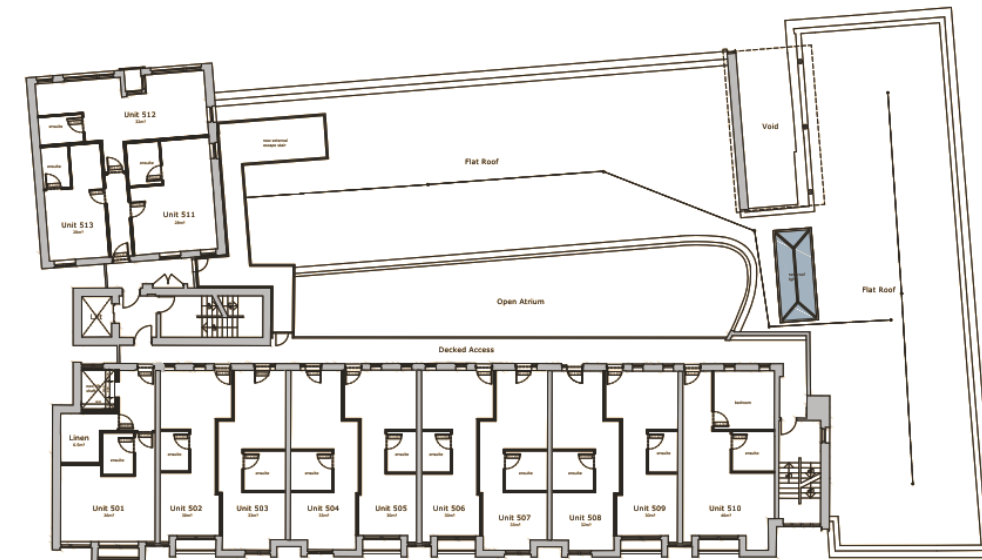
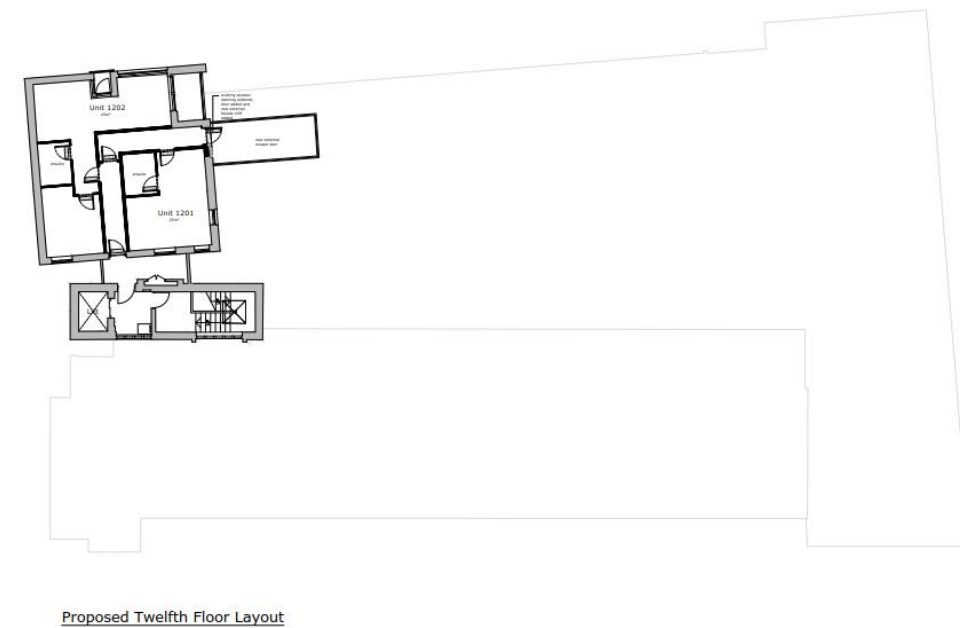


Figure 4: 7th – 12th Floor Plan



2. The Site

The site is located at Laystall St, Manchester. The site is an existing Serviced Apartments which is being redeveloped into a Marriott Hotel of 155 Hotel Suites. The façade, concrete floors and concrete walls of the existing building will be retained.

The site is located 20m to the south of Gt Ancoats St (A665), to the south of Urban Exchange a retail area, with a light industrial area to the south. A665 is a busy main road, with road traffic determining the noise climate.

The site plan and google image of site location is shown in the figures below.

Figure 5: Google Site Location



3. Noise & Acoustic Criteria

The performance specification below is based on meeting the requirements of Approved Document E and Marriott Brand requirements.

3.1. Sound Insulation

3.1.1. Regulation E1 – Sound Transmission between Rooms

Regulation E1 - "Protection against sound from other parts of the building and adjoining buildings".

Compliance with Regulation E1 will be demonstrated by on-site pre-completion sound insulation testing. The sound insulation performance for separating walls and floors for rooms for residential are specified in Table 0.1b of the "Approved Document 'E' (2003 Edition incorporating 2004, 2010, 2013, 2015 amendments)" of the Building Regulations 2003. This is replicated in the table below.

Table 1: Approved Document 'E' (2003) Separating Element Performance Standards

Table 0.1b: Dwelling - Performance standards for separating walls, separating floors, and stairs that have a separating function.		
	Airborne sound insulation $D_{nT,w} + C_{tr}$ dB	Impact sound insulation $L'_{nT,w}$ dB
Rooms for Residential (formed by material change of use)		
Walls	≥ 43	-
Floors and stairs	≥ 43	≤ 64

3.1.2. Regulation E2 – Sound Transmission within a Dwelling

Regulation E2 - "Protection against sound within a dwelling-house etc".

The requirement is that such internal partitions should be rated at no less than 40 dB R_w when laboratory tested in accordance with ISO 140-3 1997 and rated in accordance with ISO 717-1:1997.

The Approved Document 'E' only specifies a performance for walls between bedrooms or WC's and any other rooms for residential room. There is no specified performance for walls with doors in them.

3.1.3. Marriott Brand Standards

The Marriott Brand Standards provide criteria as an STC and IIC. This is an American standard and differs to building regulations. We understand this standard only applies to the communal areas only. The sound insulation to hotels rooms are to be designed to meet Regulation E1 and E2 of Building Regulations only.

3.1.4. Other areas

In addition to the criteria stated above, we would recommend that between the communal spaces and hotel rooms; plant rooms and hole rooms; and lift shaft and hotel rooms, the design criteria is increased. This is to protect the occupiers from noise generated in these spaces. The criteria is as noted in Table 2 below.

3.1.5. Summary of Sound Insulation Criteria

The following table summarises the minimum sound insulation between the rooms of the development based on the above sections. This criterion should be agreed with the brand.

Table 2: Summary of Sound Insulation Performance

Source Room Type	Receive Room Type	Airborne Criteria	Impact Criteria ¹
Hotel Room	Hotel Room	Walls - ≥ 43 dB $D_{nT,w} + C_{tr}$ Floors - ≥ 43 dB $D_{nT,w} + C_{tr}$	≤ 64 dB L'_{nTw}
BOH	BOH	≥ 37 dB $D_{nT,w}$	≤ 64 dB L'_{nTw} ⁴
Car Park Car Lift Public Toilet Kitchen	Hotel Room Office	≥ 55 dB $D_{nT,w}$ ²	≤ 64 dB L'_{nTw}
Lounge Dining Kitchen	Hotel Room	≥ 60 dB $D_{nT,w}$ ²	≤ 64 dB L'_{nTw}
Plant Room Substation Mechanical Riser Lift	Hotel Room	≥ 65 dB $D_{nT,w}$ ²	≤ 64 dB L'_{nTw}

¹ Criteria within receive room

² This is a recommended criteria only and applies to both walls and floors. The minimum requirement is Approved Document E.

3.2. Room Acoustics

With the exception of the circulation spaces which open directly into apartments (Regulation E3) the room acoustics requirements below are a recommendation not a planning or building regulations requirement.

3.2.1. Regulation E3

Regulation E3 - "Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes".

Within the communal corridors which open into the Hotel suites the reverberation time needs to be suitably controlled for Building Regulations. There are two methods of demonstrating compliance, Method A and B. these are provided in further detail in Section 6 below.

3.2.2. Other Areas

In addition to the criteria stated above, the reverberation time within the public spaces should be suitably controlled. The following criteria should be achieved. The criteria is based on a 'T_{mf}', the average reverberation time at the mid frequency bands, 500Hz-2kHz. This criterion should be agreed with the brand.

Table 3: Reverberation Time (T_{mf}) in other areas

Room Type	Maximum T _{mf} (seconds)
Lounge/Dining	1.0
Public Toilets	1.5
Staff Areas (Offices etc)	1.0

3.3. External Noise Ingress

The internal ambient noise levels due to external sources within all spaces will need to be suitably controlled. The Marriott Brand Standards provide the following noise criteria for Indoor Ambient Noise Levels (IANL) within rooms of the development affected by external noise. We understand the scheme is targeting these limits.

Figure 6: Marriot Brand IANL from External Sources

2. Guestroom Areas: Limit noise intrusion levels to Hourly Equivalent Levels (LEQ) of 45 dBA for day; 40 dBA at night.
 - a. Short Term Noise: 50 dBA for short term (day / night) noise such as sirens and low level helicopter flights.
 - b. Day - Night Level (LDN) of 45 dBA for aircraft noise level intrusion.
3. Meeting Spaces: Limit noise intrusion levels to 40 dBA or as determined by consultant's report and accepted by MI.

3.4. Building Services Noise & Vibration

The Marriott Brand Standards provide the following noise criteria for building services:

Figure 7: Marriot Brand NC for Building Services

3. Maximum NC 37 for Public Spaces and Guestrooms and NC 40 for Back-of-House areas.

3.5. Lift Noise & Vibration

Noise from the lift should be controlled to acceptable levels. The maximum recommended noise levels within the rooms due to lift operation should not 25 dB L_AF_{max}.

4. Baseline Noise Survey

A site noise survey was undertaken in June 2021 to determine the existing noise climate at the site.

4.1. Monitoring Equipment

Sound Pressure Levels were measured using three Class 1 sound level meters with a half-inch condenser microphones, using the 'fast' setting.

The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 4: Equipment and Calibration Status

Location	Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
LT1	SLM, NTI, XL2	A2A-13617-E0	13/09/2018	FL-18-082
	Pre-Amp, NTI, MA220	7727	13/09/2018	FL-18-082
	Microphone, NTI, MC230A	A16151	13/09/2018	FL-18-082
	Calibrator, Larson Davis, CAL200	12605	27/08/2019	32690

The measurement system was checked before and after use with the noted calibrator and no significant drift was detected.

4.2. Weather Conditions

Conditions during the survey were generally dry and clement, with an average temperature approximately 17 degrees Celsius and wind speeds not normally exceeding 5 metres per second.

4.3. Monitoring Procedure

A long term monitoring exercise was undertaken outside of Room 201 (LT1) overlooking Laystall St. LT1 was to the north east elevation at second floor level. The microphone was in a façade position. Monitoring Location is displayed below in Figure 8.

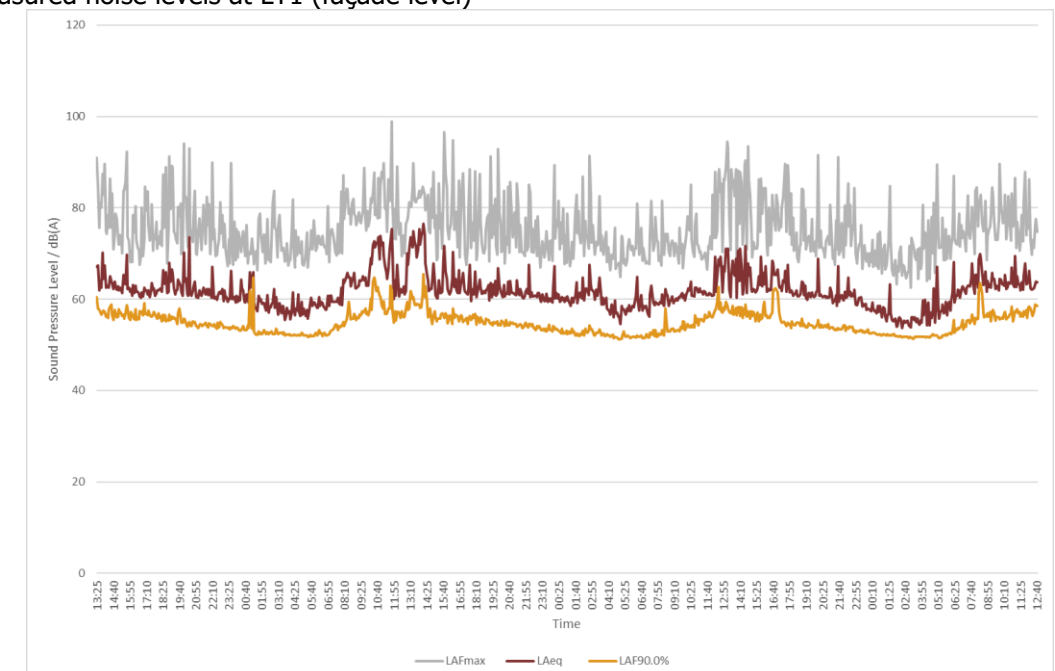
Figure 8: Monitoring Location



4.4. Measured Noise Levels

Measurements were completed in accordance with BS8233:2014, BS7445 and BS4142:2014. The relevant data from the survey is the A-weighted L_{eq} , and L_{max} , spectral values and L_{A90} values which are displayed below in both tabulated and graph form below. The variation in noise levels is provided below:

Chart 1: Measured noise levels at LT1 (façade level)



The tabulated octave band data from this location is given below.

Table 5: Logarithmically averaged noise data from LT1 (façade level)

Period	Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
		63	125	250	500	1000	2000	4000	8000	
Day	L _{eq16hr}	75	66	64	62	61	57	52	55	65
Night	L _{eq8hr}	76	61	59	56	55	52	47	40	60
	L _{Fmax}	79	86	86	87	86	80	61	54	89
Day	L _{eq1hr} *	77	68	68	67	66	63	59	64	71
Night	L _{eq1hr} *	76	61	59	58	56	54	48	38	61

* Brand criteria is a 1hr level. Therefore, more onerous.

The background sound levels at LT1 are as follows, this data is used to determine the plant limits and is considered most representative of the dwellings in the vicinity to the east:

Table 6: Baseline Background Sound Levels LT1 (façade level)

Period	L _{A90,15min}	
	Range	Mode
Day (07:00 - 23:00)	52 - 66	56
Evening (19:00 - 23:00)	53 - 58	54
Night (23:00 - 07:00)	51 - 65	52

5. Internal Sound Insulation

5.1. Pre Works Testing

Pre works testing has been completed across the scheme for airborne sound transmission of the retained concrete walls and floors. Testing was completed in the following areas with the results noted. In all tests the sound was transmitting both through the floors/walls and also along the flanking elements.

Figure 9: Pre Works Sound Test Locations

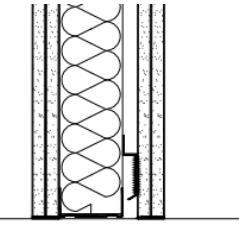
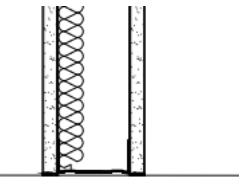
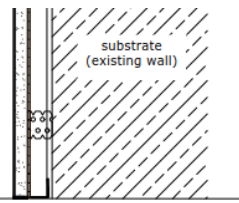
Test	Source and Receive Room	Measured dB $D_{nTw+Ctr}$	Criteria dB $D_{nTw+Ctr}$	Pass / Fail
W1	210 to 209	39	>43	Fail (-4dB)
W2	208 to 209	43		Pass
F1	209 to 109	42		Fail (-1dB)
F2	211 to 111	40		Fail (-3dB)
F3	202 to 102	42		Fail (-1dB)

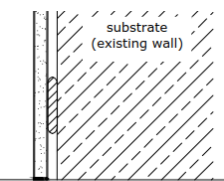
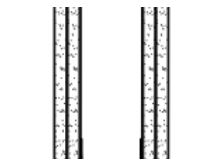
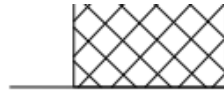


5.2. Separating Walls & Floors

The table below provides the recommendations on the proposed walls throughout the scheme to meet the performance above. Our comments on these construction types are also provided. It should be noted that all separating walls should run slab to slab and should be fully sealed with mastic or mortar. The laboratory rated (R_w) performance is to be used as a guide only. Walls within a hotel suite (Regulation E2 walls) can run from slab to ceiling if preferred. Subject to the correct detailing, upgrades where requested and installation the performance criteria can be achieved.

Table 7: Wall and Floor Build ups

Type	Required Performance		Partition Description
	On Site	Laboratory	
 WALL TYPE 01 Apartment Separating Wall British Gypsum System Reference: A316009	$\geq 43 \text{ dB } D_{nT_w} + C_{tr}$	$\geq 50 \text{ dB } R_w + C_{tr}$	These partitions are a single stud system of: 2 layers of staggered and sealed 15mm plasterboard (mass $\geq 24\text{Kg/m}^2$). 70mm C Stud. 50mm mineral wool within cavity. 16mm Resilient bar one side. 2 layers of staggered and sealed 15mm plasterboard (mass $\geq 24\text{Kg/m}^2$).
 WALL TYPE 02 Ensuite to Bedroom Bedroom Wall British Gypsum System Reference: A206046	--	$\geq 40 \text{ dB } R_w$	This partition can be downgraded as follows: Option 1 1 layer of 12.5mm Wallboard plasterboard (mass $> 8\text{Kg/m}^2$). 70mm C Stud. 25mm of mineral wool within cavity 1 layer of 12.5mm Wallboard plasterboard (mass $> 8\text{Kg/m}^2$). Option 2 1 layer of 12.5mm Soundbloc plasterboard (mass $> 10\text{Kg/m}^2$). 70mm C Stud. 1 layer of 12.5mm Soundbloc plasterboard (mass $> 10\text{Kg/m}^2$). This build up is only required to walls within a Hotel suite without doors in them. Where there is a door any partition can be installed.
 WALL TYPE 03 Ensuite Riser British Gypsum System Reference: tbc	--	--	Subject to plant within riser this is acceptable, plant details to be issued to us for comment.
 LINING TYPE 01 (to existing structure) System Reference: N/A	$\geq 43 \text{ dB } D_{nT_w} + C_{tr}$	$\geq 50 \text{ dB } R_w + C_{tr}$	The existing walls currently fail to meet Regulation E1. The linings will improve the performance. We would advise this lining is applied to all existing separating and flanking walls with the following upgraded build up: 1 layer of sealed 15mm plasterboard (mass $\geq 10\text{Kg/m}^2$). - Gypliner 25mm mineral wool within cavity. - Masonry wall, assumed 190m concrete.

Type	Required Performance		Partition Description
	On Site	Laboratory	
 LINING TYPE 02 (to existing structure) System Reference: N/A	$\geq 43 \text{ dB } D_{nTW} + C_{tr}$	$\geq 50 \text{ dB } R_w + C_{tr}$	The existing walls currently fail to meet Regulation E1. Lining Type 02 should be upgraded to Lining Type 01 with mineral wool.
 WALL TYPE 04 FoH to FoH British Gypsum System Reference: A206014	$\geq 37 \text{ dB } D_{nTW}$	$\geq 44 \text{ dB } R_w + C_{tr}$	We would advise this wall is upgraded as follows where between two sensitive FOH areas: • 1 layer of sealed 15mm plasterboard (mass $\geq 8\text{Kg/m}^2$). • 70mm C stud • 25mm mineral wool within cavity. • 1 layer of sealed 15mm plasterboard (mass $\geq 8\text{Kg/m}^2$).
 WALL TYPE 05 Reception to BoH BoH to BoH British Gypsum System Reference: A206251	$\geq 37 \text{ dB } D_{nTW}$	$\geq 44 \text{ dB } R_w + C_{tr}$	These partitions are acceptable to BOH areas and are a single stud system of: • 2 layers of staggered and sealed 15mm plasterboard (mass $\geq 20\text{Kg/m}^2$). • 70mm C Stud. • 2 layers of staggered and sealed 15mm plasterboard (mass $\geq 20\text{Kg/m}^2$).
 WALL TYPE 06 Housekeeping Refuse Cycle Store System Reference: N/A	n/a	n/a	These partitions are acceptable to BOH areas but may need upgrading for flanking. Flanking upgrade would be as per lining Type 01. This can be determined once junction details are issued
	$\geq 43 \text{ dB } D_{nTW} + C_{tr}$ $\leq 62 \text{ dB } L_{nT,w}$	n/a	As can be seen above the tested floors failed to meet Regulation E1. The results do not indicate a 185mm concrete slab, however the lower performance maybe due to flanking. The floor will need to be upgraded as follows: • Either carpet or resilient floor finish meeting the following performance: a) any resilient material, or material with a resilient base, with an overall uncompressed thickness of at least 4.5mm; - or a) any floor covering with a weighted reduction in impact sound pressure level (ΔL_w) of not less than 17dB when measured in accordance with British Standard EN ISO 140-8:1998 and calculated in accordance with British Standard EN ISO 717-2:1997. • Floor slab with minimum mass of 300Kg/m². If mass is lower please advise. • Ceiling below of one layer of 12.5mm Wallboard on a meta frame creating a 75mm (min) cavity.

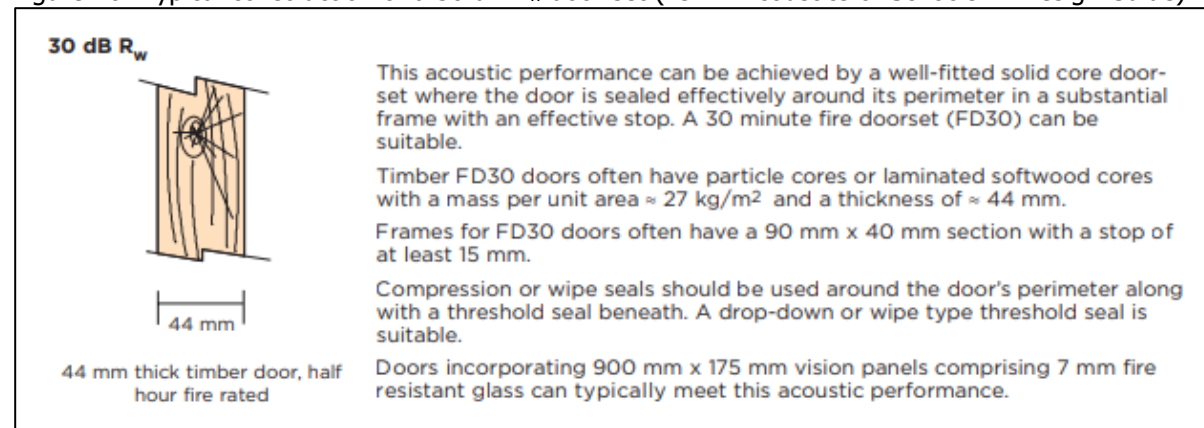
5.3. Doors

Where the entrance door of a dwelling opens into a communal circulation area there is a building regulations requirement for the door to provide a reasonable level of sound insulation. There are two options for satisfying this requirement. Either:

- Select a door-set which is supplied with laboratory test data verifying a minimum performance of 29 dB R_w
Or:
- Ensure the doors used have a minimum mass of 25 Kg/m² and are fitted with good perimeter seals (including the threshold where practical).

The typical construction of a 30 dB R_w door set is shown below.

Figure 10: Typical construction of a 30 dB R_w door set (IOA – Acoustics of Schools: A Design Guide)



5.4. Flanking Details

The following flanking details are in outline and will be developed as the scheme progresses. The detailing in all areas will require careful consideration.

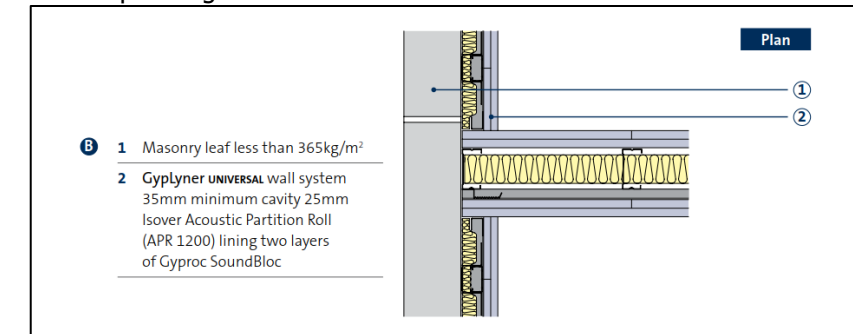
5.4.1. Steelwork

Where steelwork is exposed within a room it will need to be encased with two layers of rigid plaster board (mass $\geq 20 \text{ Kg/m}^2$) with 50 millimetre of mineral fibre (density $\geq 30 \text{ Kg/m}^3$) within the cavities. The plasterboard encasement and associated support system should be totally independent of the steelwork or on resilient fixings. Once the extent of the steelwork is known please provide us with details for comment.

5.4.2. Flanking Walls

Where a masonry wall or other solid masonry element is retained and the separating wall abuts this element then a liner will also be required. The lining should follow the below British Gypsum detail where the masonry or other solid element has a mass $\leq$ than 365 Kg/m².

Figure 11: Masonry Wall to Separating Wall Junction



5.4.3. Curtain Walling

If there is curtain walling throughout the scheme. These will be a flanking weak path, it is advised the mullions and transoms are filled with Siderise mineral wall inserts which achieve a minimum flanking sound transmission of 55 dB $D_{nFw} + C_{tr}$.

5.4.4. Separating Wall Head Detail

The partition head detail will need to be suitably addressed. Separating walls should run from slab to slab. All junctions should be fully sealed with dense non setting mastic.

5.4.5. Resilient Bar Installation

Resilient bars are commonly installed incorrectly. This can cause significant reduction in performance and failures. An incorrect and correct installation is shown below:

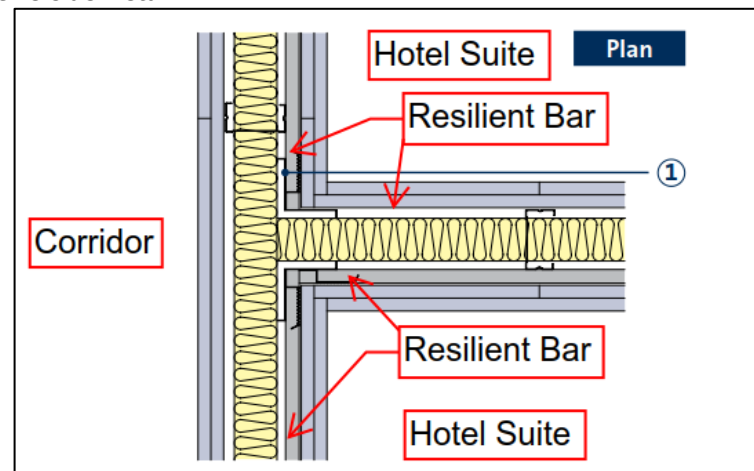
Figure 12: Resilient Bar Install



5.4.6. Resilient Bars (one side)

As noted above we have advised in a number of places the resilient bar can be located on side only. This is normally between a hotel room and a corridor. Where this is the case the resilient bar should be located Hotel suite side. As shown on the annotated British Gypsum detail below:

Figure 13: Resilient Bar One side Detail



5.4.7. Roof Detail

We would advise that the separating walls should run fully to the underside of the roof. Where there are common flanking elements such as steel roof joists, a mass barrier plasterboard ceiling is to be installed within the hotel rooms. The ceiling should comprise of the following and should not be continuous between dwellings:

- Two skins of staggered and sealed 12.5mm dense plasterboard (density at least 10 Kg/m² per board).
- A MF system with resilient hangers, such as the British Gypsum GAH Acoustic Hangers.
- Cavity of at least 100mm with 50mm of Isover APR1200 mineral wool insulation (density at least 24 Kg/m³) within cavity.

5.4.8. Floor Slab

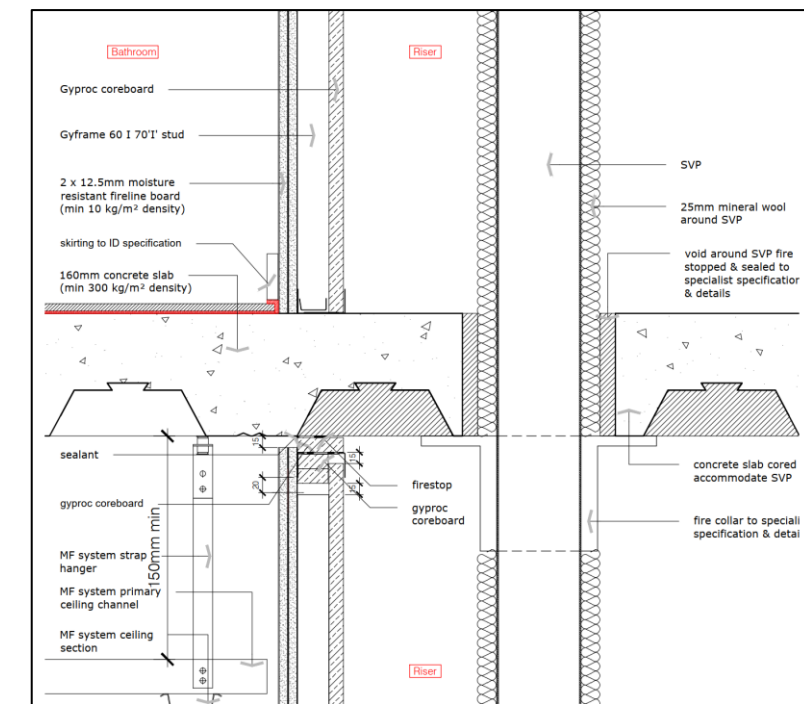
There is a common floor slab under all separating walls. This slab should be selected to achieve a minimum mass of at least 300 Kg/m². Any reduction in this mass should be checked for compliance.

5.4.9. Floor Penetrations

Pipes and ducts, SVP, RWP that penetrate a floor separating different rooms for residential should be enclosed for their full height in each room. The enclosure should comprise of plasterboard (mass ≥ 15 Kg/m²) and 25mm mineral wrapped around the pipes/ducts/SVP/RWP.

There should be a small gap of approximately 5 millimetres between the enclosure and the floor slab. This should be sealed with sealant or neoprene. A typical and acceptable Maith Design Architects detail (as per Romford) is provided below:

Figure 14: SVP Detail



5.4.10. Other Services

Downlighters

If the ceiling is punctured to install services, then the performance of the floor will be affected. The ceiling can include holes cut for recessed lighting, provided they are maximum 100mm across; and no more than one per 2m² of ceiling in the room affected.

Therefore, for most bedrooms of about 10m² the room can be fitted with up to five recessed light fittings. The downlighters should be spaced at a minimum of 1 downlighter per 2m² of ceiling area and at not less than 0.75m spacings. (e.g. 10m² of ceiling area equates to at least 5 downlighters).

Supply and Extract Fans

Extract fans can also be accommodated, but with these, the aperture has to be fully sealed to the duct to prevent air paths into the ceiling void; and the duct must not create a rigid connection of the ceiling lining to the floor structure. Other issues such as fire, and the environmental noise of the fan operating, will also need to be considered.

Any ductwork exiting the ceiling must be fully boxed-in using gypsum board to the same specification as that used for the ceiling.

Inspection Hatches

A number of services can be run above the ceiling; and if this includes a gas flue, you may need to think about fitting inspection hatches. If this is the case, then ensure the hatch is acoustically rated to be at least as good as the gypsum board that it is replacing.

Further Advice

If number or size of apertures is larger than described above, then we would recommend installing a secondary ceiling to take the fittings. This will ensure the primary ceiling remains intact. The secondary ceiling should be hung from the metal frame or resilient bars, and not from the structural floor.

Alternatively acoustic rated hoods should be placed over the back of the service penetrations or acoustically rated products should be installed.

5.4.11. Service Routes between Dwellings and Communal Areas

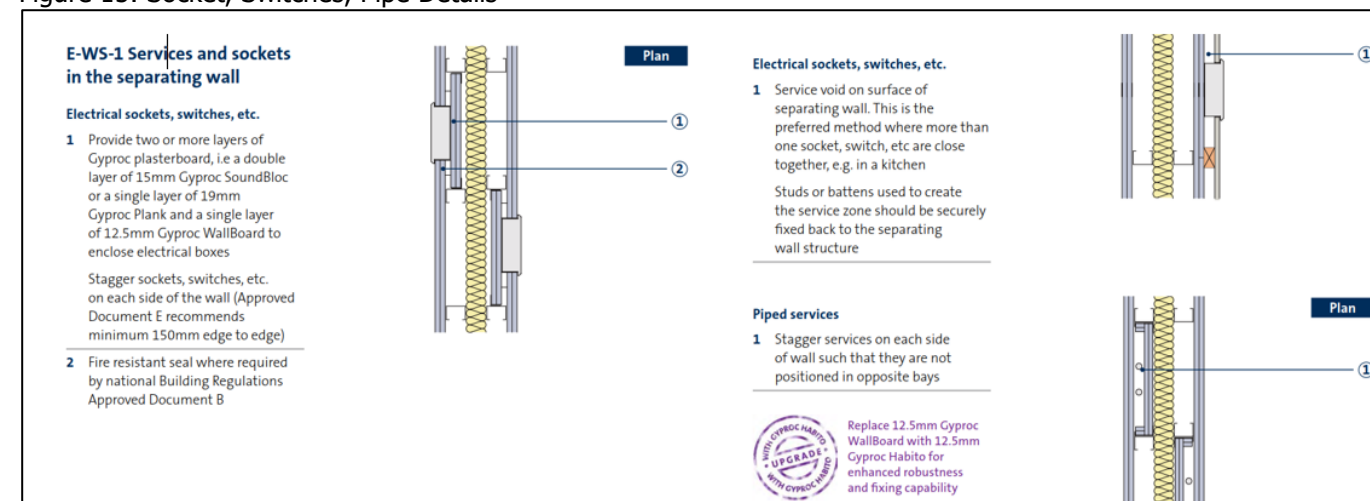
Where any service penetration is between a hotel room and a corridor, the infill material is required to achieve a sound reduction rating of at least 40 dB R_w . A number of propriety products can meet this requirement.

Services should run from the corridor into the hotel room and not directly through the separating walls. There should be no ventilators, services, cable trays, air return grilles, holes etc. between dwellings unless suitably addressed for flanking. We can address these if provided with details.

5.4.12. Sockets, Switches, Pipes

All electrical sockets/switches, chases etc. should be staggered on each side of the separating wall. The boxing in of electrical sockets etc should be as follows:

Figure 15: Socket, Switches, Pipe Details



6. Room Acoustics

6.1. Regulation E3

In the communal corridors and hallways an area not less than the floor area must be fitted with a 'Class C' absorber or better. This could be achieved by fitting the entire ceiling area of such spaces with a sound absorbing ceiling tile system having a British Standard EN ISO 11654:1997 rating of Class A, B or C.

To stair enclosures the required area of absorbing material is specified by adding together the following areas:

- area of the stair treads
- area of the upper surface of the intermediate landings
- area of the upper surface of the landings (excluding that on the ground floor)
- area of the ceiling area on the top floor

An area equal to the combined total needs to be fitted with a Class 'D' absorber.

OR

An area equal to half the combined total needs to be fitted with a Class 'A', 'B' or 'C' absorber. The area of required absorption can be fitted to the walls or ceiling but should be spread out equally between floor levels.

Reputable ceiling tile manufacturers should be able to provide British Standard EN ISO 11654:1997 ratings for their systems. 'Rockfon' and 'Armstrong' ceiling tile systems are supplied with British Standard EN ISO 11654:1997 class ratings. Some ceiling systems can be fixed directly to the existing ceiling without the need for a grid support system.

Some manufacturers of ceiling systems will propose and supply the appropriate treatments for the common areas of the building and will supply written confirmation that it complies with the Regulation E3. This can then be used, if necessary, as part of the Building Regulations submission. These include, Armstrong Tiles, Ecophon Acoustic Ceilings and Rockfon Ceiling Solutions.

6.2. Other Areas

We can address other areas once ground floor communal areas layouts are finalised

7. External Noise Control

7.1. Noise Modelling

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the road traffic noise data noted above.

The software predicts road traffic noise propagation using the method of 'The Calculation of Road Traffic Noise 1988', and a verification model has been created to ensure the measured and predicted levels are comparable. This model is available upon request.

The following daytime $L_{Aeq}(1hr)$, night-time $L_{Aeq}(1hr)$ and maximum noise levels L_{AFmax} maps have been created of the road traffic noise.

Figure 16: Daytime dB $L_{Aeq}(1hr)$ Road Traffic noise affecting development

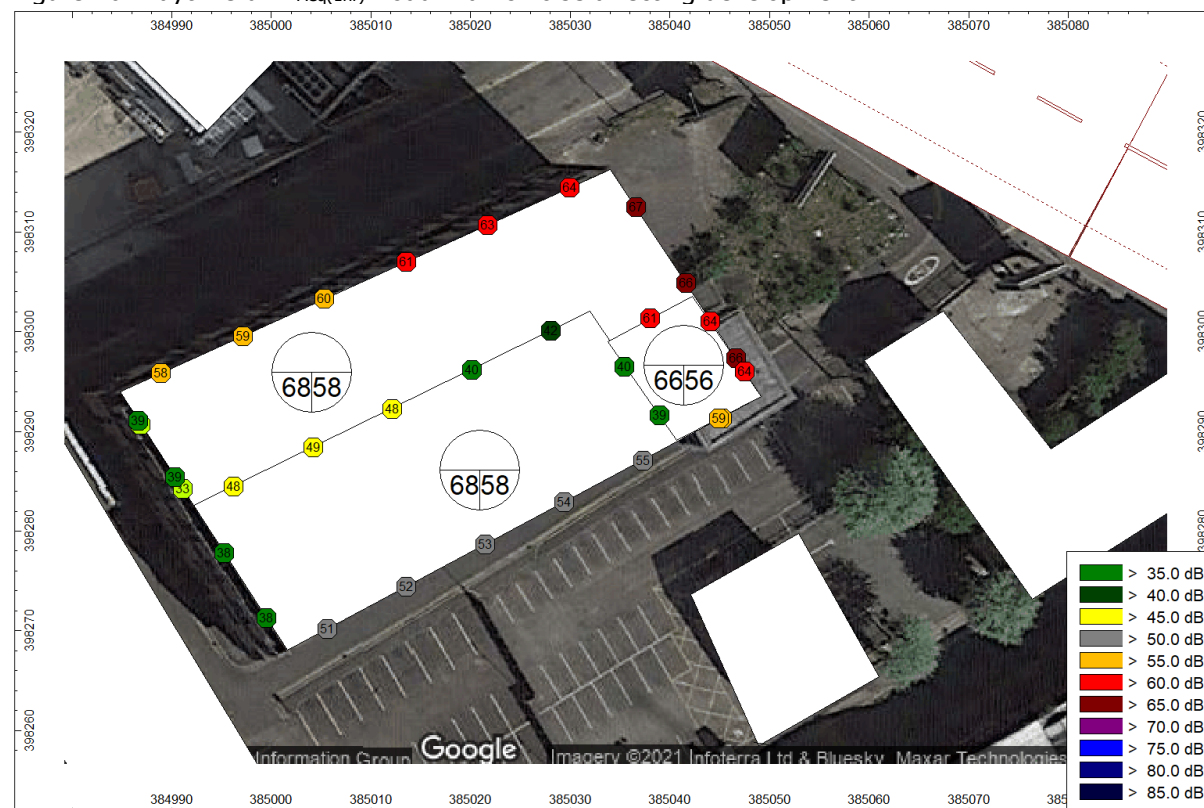


Figure 17: Night-time dB $L_{Aeq}(1hr)$ Road Traffic noise affecting development

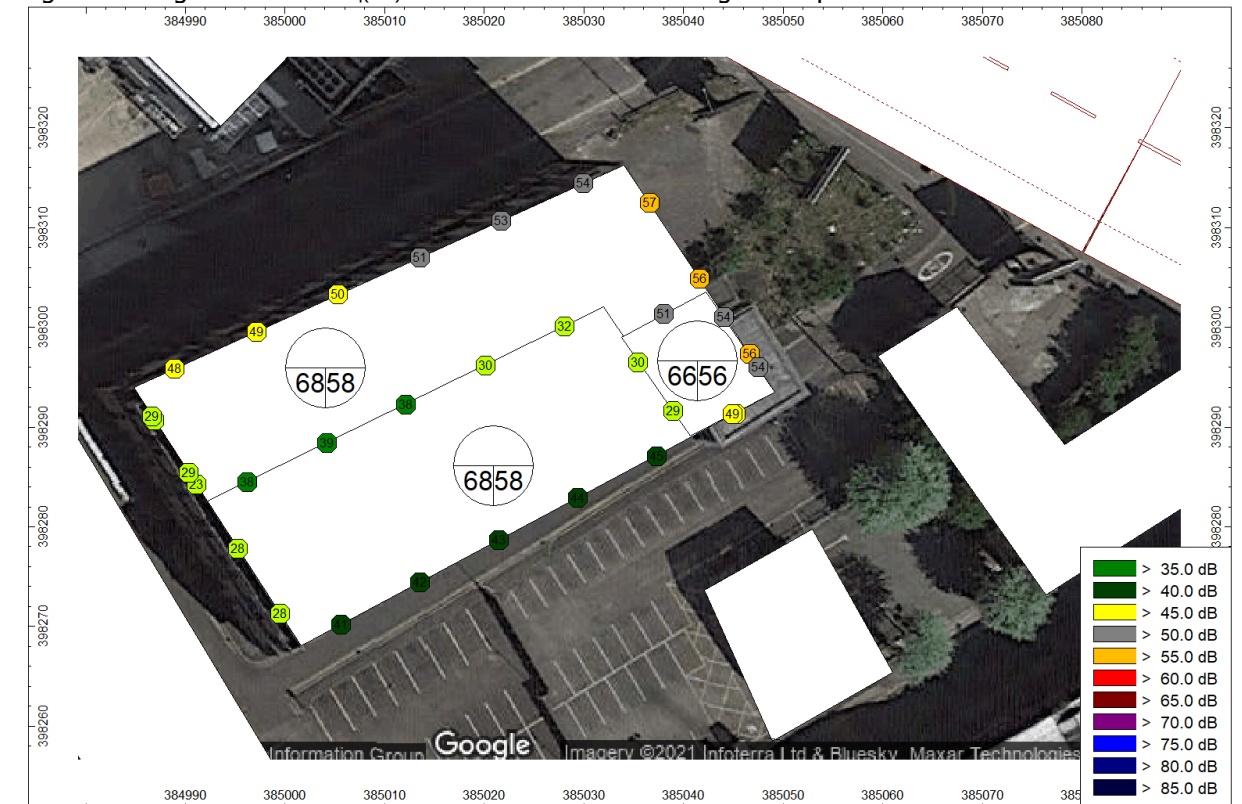
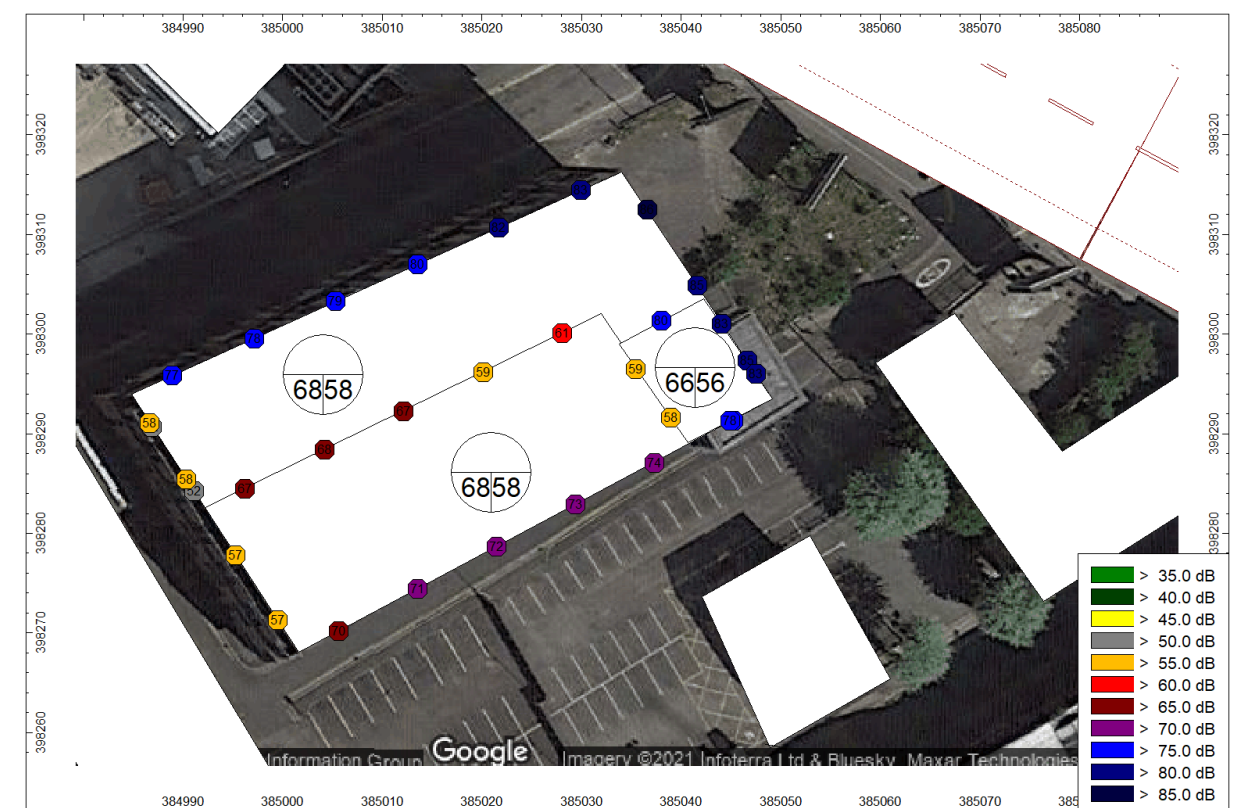


Figure 18: Day and Night dB L_{AFmax} Road Traffic noise affecting development



7.2. Calculation Method

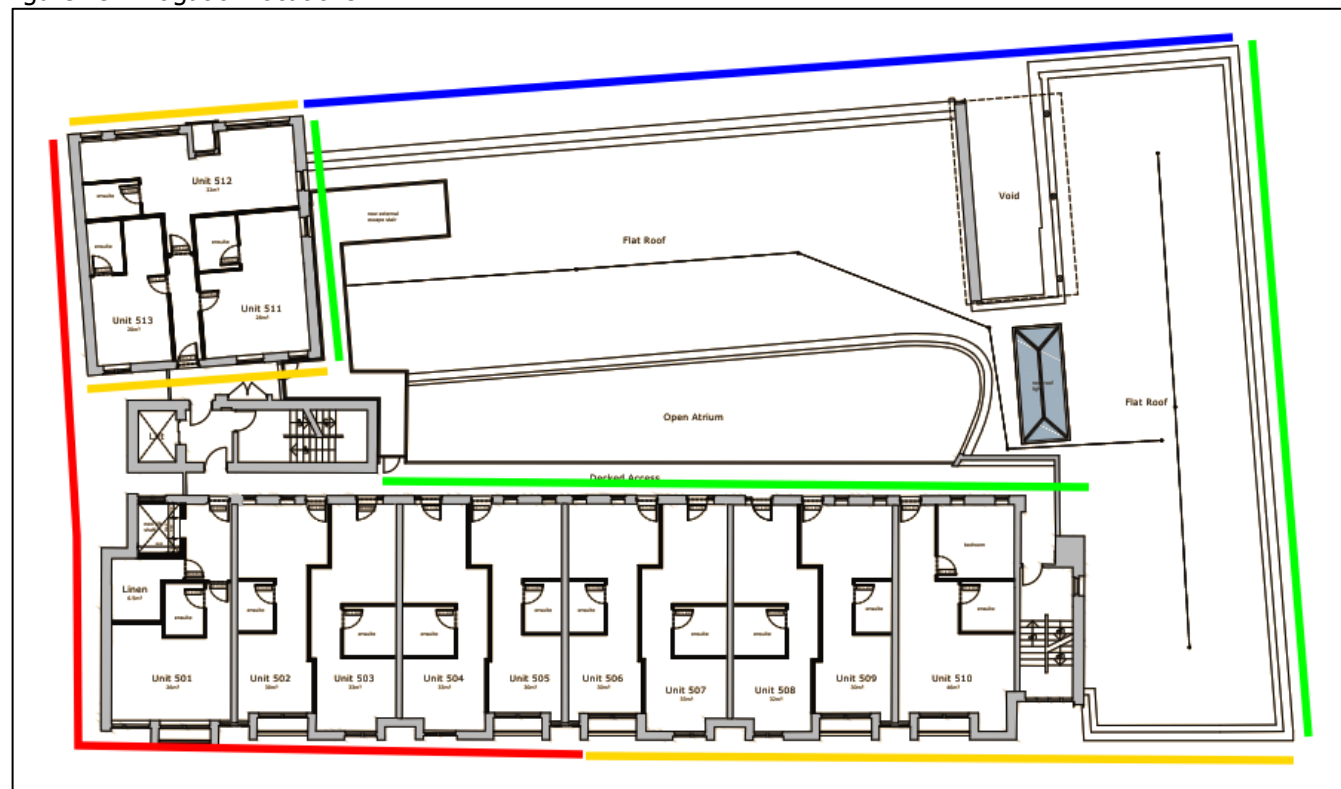
Calculations for the internal ambient noise levels have been undertaken using the calculation method provided by Annex G of British Standard 8233:2014. The calculations have been undertaken using traditional building façade constructions noted within this section and noise modelling and survey results.

Alternative constructions to those noted below could be used, however they would need to be assessed to ensure they control external noise to within the recommended internal ambient noise level criteria.

7.3. Mitigation Locations

We have rationalised mitigation measures down to four façades in order to keep the acoustic design of the scheme as concise as possible. The mitigation locations are marked up in Figure 19 below.

Figure 19: Mitigation locations



7.4. External Wall Construction

The external walls in all areas are existing and assumed to be at least two skins of 100mm block/brick. These constructions are expected to achieve the following minimum sound reduction indices:

Table 8: Minimum sound reduction index of external walls

All Facades	Freq. (Hz)	63	125	250	500	1k	2k	4k	8k	R _w
	R (dB)	31	38	46	45	55	66	77	70	52

7.5. Window Construction

The windows on all elevations could be openable but should normally be sealed airtight to control external noise with an alternative form of ventilation provided.

The windows should be constructed from a double-glazed construction housed in sturdy and good quality frames with airtight compression seals.

The sound insulation performance for the windows should achieve the following as a minimum, a typical build up is also provided. The supplier should confirm the performance (octave band R and R_w) is achievable with the chosen systems.

The performance for the hotel suites and ancillary spaces is provided below:

Table 9: Required minimum sound insulation of windows

Façade	R dB per Octave Band (Hz)								R _w (dB)	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
	22	27	29	36	41	42	52	50	39	10/12/6.4lam
	21	26	27	34	40	38	46	46	37	10/12/6
	20	24	20	25	35	38	35	36	31	4/12/4
	20	24	20	25	35	38	35	36	31	4/12/4

7.6. Ventilation Provisions

The ventilation provisions should include the necessary sound attenuation in order that the ingress of external noise is controlled to be compatible with the building fabric. The supplier of any chosen ventilation product should provide test data confirming that the ventilation system meets the following performance data.

If trickle vents are required the vents will need to achieve the following performance:

Table 10: Required D_{ne} of trickle vents

Façade	D _{ne} dB per Octave Band (Hz)								D _{new} (dB)	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
	45	47	46	50	55	65	68	60	54	Greenwood MA3051
	45	47	46	50	55	65	68	60	54	Greenwood MA3051
	30	38	38	33	36	47	49	57	39	Acoustic Trickle Vent
	30	35	35	36	34	29	33	34	32	Standard Trickle Vent

7.7. Effect of Mitigation Measures

With the mitigation measures installed to habitable rooms of the hotel suites in the areas noted above, the predicted internal noise levels are below the Brand requirements and we would consider external noise ingress to be acceptable.

7.8. Effect of Retaining Vents & Glazing

We understand the existing glazing and trickle vents maybe retained. The glazing is assumed to be standard double glazing, and the vents we understand are standard trickle vents. With the retained vents and windows the predicted performance is as follows:

Table 11: Predicted Internal Level of Existing Windows and Vents

Period	Parameter	Façade	Predicted Level	Brand Criteria	Within Brand
Day	L _{eq1hr} *	Red	44	45	YES
Night	L _{eq1hr} *		35	40	YES
	L _{Fmax}		62	50	NO (+12dB)
Day	L _{eq1hr} *	Orange	39	45	YES
Night	L _{eq1hr} *		31	40	YES
	L _{Fmax}		60	50	NO (+10dB)
Day	L _{eq1hr} *	Blue	30	45	YES
Night	L _{eq1hr} *		22	40	YES
	L _{Fmax}		50	50	YES
Day	L _{eq1hr} *	Green	23	45	YES
Night	L _{eq1hr} *		15	40	YES
	L _{Fmax}		44	50	YES

If the vents were increased only, to Greenwood MA3051 wall vents, then the predicted level exceeds the criteria by a lower level, of +6dB and +8dB in Orange and Red areas respectively.

However the only method of reducing the noise levels in the Orange and Red areas to Marriot Brand requirements are to increase both the vent and glazing performance to as noted in Table 9 and Table 10 above.

8. Building Services Noise & Vibration Control

8.1. External Plant Noise Limits

Any plant associated with the proposed hotel is understood to operate 24 hours a day. We have provided plant noise limits at the nearest noise sensitive dwellings based on the monitoring data obtained above and British Standards 4142:2014.

Based on the above criteria and operational hours, the maximum cumulative rating sound level limit of noise from plant associated with the development are as follows.

Table 12: Free-field Plant Rating Level limits

Location	Period	Plant Limits L _{Ar,15min} dB
Existing Dwellings	Day (07:00 - 23:00)	53
	Evening (19:00 - 23:00)	51
	Night (23:00 - 07:00)	49
Hotel Roof (external to light well)	Anytime	NR55
Hotel (within light well)	Anytime	NR35

The plant should be selected to ensure any character (tonality, intermittency or other sound characteristics) are not readily distinguishable at the dwellings. If character is present a character correction should be applied as per BS4142:2014.

8.2. Plant Room Noise Limits

The noise generated by any plant will need to be controlled to acceptable levels. Based on current known building structure information, we would advise the noise within all plant rooms to be controlled to no more than NR65.

Once the plant details are finalised, we can advise further.

8.3. Noise Limits within Sensitive Rooms

Noise from the mechanical system should meet the performance noted in Section 3.4. This should include duct borne noise, grille noise, vibration and structure borne noise. It is the M&E installers responsibility to ensure this is met.

8.4. Building Services Vibration

All plant, flues, duct and equipment should be provided with vibration control provisions.

The installer/manufacture of the plant should confirm the proposed system will not cause excessive vibration and/or structure-borne noise to any parts of the building.

It is advised that the proposed fans and compressors are provided with vibration control provisions. They will all require anti-vibration supports.

The supports however, will need to be of a specialist supply. The supports should be selected by specialist suppliers to provide an isolation efficiency of at least 95% at the lowest forcing frequency. Please note that the systems will deflect and the design would need to cater for this element.

It will also be necessary to provide flexible vibration isolation provisions on the duct connections. If required this would include the pipe work, ductwork and electrical services (which can be coiled) connections. The isolated ductwork and pipe work support to all services should be fitted with specialist mounts to provide an isolation efficiency of at least 95% at the lowest forcing frequency.

It is advised that the necessary anti-vibration provisions on plant and equipment are made to ensure compliance with the design noise and vibration levels.

8.5. External Plant Assessment

The external will be completed once issued with M&E details.

9. Detailing, Workmanship & Verification

Noise control predictions have been based on the constructions as listed in this report with no allowance made for weak points. Small weaknesses in the fabric design and/or installation are likely to significantly reduce the predicted noise control performance. Predictions are based upon the best available information with regards to the performance of the building materials and systems.

It is therefore necessary to ensure that all detailing is carefully designed so that there are no weak points present. All brick and blockwork joints should be completely in-filled with mortar. It is also necessary to provide comprehensive site construction checks to ensure that the installation matches the design intent. In general terms it should also be noted that there should be no gaps in the constructions and that all components should be carefully sealed airtight using suitable dense non-setting mastics (NOT FOAM) where appropriate. All walls, unless noted otherwise, should run the full height up to the slab soffit or underside of the roof. The details at these joins will require careful consideration.

All the elements should be constructed in accordance with the manufacturer's recommendations.

In terms of achieving the acoustic requirements of particular elements as noted in this report, the only contractual link is between the Contractor (the Builder) and Supplier. As such, it is very important that all purchase contracts include for the particular elements to comply with the acoustic requirements as noted in this report. The verification should be in accordance with the appropriate British Standard or International Standards Organisation Standards. Weighted sound reduction indices (R_w) should be measured in accordance with British Standard EN ISO 140-3:1995 and rated in accordance with British Standard EN International Standards Organisation 717-1:1997. Sound absorption coefficients should be in accordance with International Standards Organisation 354 and rated in accordance with British Standard EN ISO 11654:1997.



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