



JONES HARGREAVES

20 HIGH STREET, UXBRIDGE

ACOUSTIC DESIGN REPORT

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1.0 INTRODUCTION

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by Jones Hargreaves to undertake an acoustic design review of the design proposals for the conversion of the upper 2 floors of 20 High Street, Uxbridge, into 4 apartments.
- 1.2 20 High Street is a 3 storey Grade II listed building, with sections built in the 16th, 17th and 20th centuries. AEC understands that there are no parts of the internal structure which are listed, and therefore, there are no restrictions on the work that can be undertaken within the building.
- 1.3 Currently the ground floor is occupied by Kokoro noodle bar and the first and second floors are unoccupied. The scheme includes the development of 4 apartments, 2 on each of the first and second floors. The development is bound to both sides by relatively modern 3 storey office blocks. It should be noted that only the front section of the building is connected to the buildings either side.
- 1.4 This report provides a summary of the relevant acoustic design criteria, based on guidance such as BS 8233 (2014) '*Guidance on sound insulation and noise reduction for buildings*' and the requirements of Approved Document E '*Resistance to the passage of sound*' (ADE), 2003 edition (incorporating 2015 amendments) which is an approved publication for the purposes of The Building Regulations 2010.
- 1.5 The report also provides comment on the two planning conditions relating to noise associated with the development.
- 1.6 Acoustic terminology is discussed in brief in Appendix A.

CDM Regulations

- 1.7 Although this report may reference specific products and/or manufacturers, these are included as a suitable example only and there will normally be numerous alternative products that could be used.
- 1.8 The final specifications for construction materials and methods used would be prepared by others. Any potential health and safety issues associated with specified materials and construction methods must be mitigated based on all available information including that from the manufacturer and/or supplier.
- 1.9 Some of the risks associated with the use of materials and construction methods commonly suggested in relation to achieving acoustic requirements include:
 - manual handling of heavy blockwork and boards;
 - handling of hazardous substances such as mineral wool, which can be an irritant;
 - noisy construction works, where quieter alternatives should be used, and protection provided to site operatives where necessary.

2.0 ACOUSTIC DESIGN CRITERIA

General

- 2.1 The design requirements for the internal acoustics of dwelling-houses, flats and rooms for residential purposes are based on the requirements detailed in ADE and these performance standards are presented below:

- Part E1** - sound insulation to be achieved by separating walls and floors between adjacent flats or rooms for residential purposes and common areas;
- Part E2** - sound insulation of internal walls and floors within a unit;
- Part E3** - control of reverberation in common areas.

Part E1

- 2.2 The sound insulation performance standards specified in ADE, for walls and floors that have a separating function between apartments formed by a material change of use, are presented in Table 1, below:

Table 1 – Sound Insulation Performance Standards for Separating Walls, Floors and Stairs

Separating Structure	Airborne Sound Insulation $D_{nT,w} + C_{tr}$ dB (Minimum Value)	Impact Sound Insulation $L'_{nT,w}$ dB (Maximum Value)
Walls	43	-
Floors and Stairs	43	64

- 2.3 The above performances should also be achieved between apartments and any other part of the same building, and dwellings in an adjacent building.
- 2.4 In order to show compliance with ADE, a proportion of the separating walls and floors in a development need to be pre-completion tested.
- 2.5 Part E1 also identifies requirements for doorsets onto common areas, which should be designed to achieve 29dBR_w, or ensure that they have a minimum mass of 25kg/m² plus good perimeter sealing, including the threshold where practical.

Part E2

- 2.6 ADE confirms that the internal wall and floor constructions within rooms for residential purposes, whether purpose built or formed by material change of use, need to achieve a laboratory value of at least 40dBR_w. This is based on manufacturer's laboratory test data and does not require to be checked on site.

Part E3

- 2.7 In addition to the above sound insulation performance standards, a further requirement of Approved Document E is to control reverberation times, to a reasonable level, in common internal parts of buildings containing flats or rooms for residential purposes. This can be achieved by either of the following methods:

Method A: Cover a specified area with an absorber of an appropriate class that has been rated according to BS EN ISO 11654:1997;

Method B: Determine the minimum amount of absorptive material using a calculation procedure in octave bands. This method is intended only for corridors, hallways and entrance halls and is not well suited to stairwells.

Other Considerations

- 2.8 In relation to noise from lifts, Table 5 in BS8233 states that maximum noise levels due to lifts should not exceed $25dBL_{Amax}$ in bedrooms, $30dBL_{Amax}$ in living rooms and $35dBL_{Amax}$ in other habitable areas.

Planning Conditions

- 2.9 There are two planning conditions relating to noise associated with the development and these are reproduced below:

'5. The development shall not begin until a scheme for the control of noise transmission to the adjoining [dwellings] [premises] has been submitted to and approved in writing by the Local Planning Authority. The scheme shall include such combination of sound insulation and other measures as may be approved by the LPA. Thereafter, the scheme shall be implemented and maintained in full compliance with the approved measures.'

6. Prior to the completion of works to the ground floor, details shall be submitted to and approved in writing by the Local Planning Authority, of an enhanced sound insulation scheme, for the floor/ceiling/wall structures separating the ground floor use from the upper floor residential uses. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.'

- 2.10 It should be noted that the adjacent attached buildings are occupied by offices. As such, achieving the sound insulation performance requirements for the separating walls, as presented in Table 1, should adequately control noise transfer between the newly formed apartments and the adjacent premises.
- 2.11 In relation to noise from the ground floor noodle bar, it is unlikely that achieving the minimum performance requirements in ADE would suitably control noise transfer into the first-floor apartments.
- 2.12 Therefore, based on AECs experience, it is recommended that maximum noise levels in the apartment due to noise transfer from the noodle bar are controlled to not exceed $NR30_{Lmax}$.

3.0 ASSESSMENT OF WALL CONSTRUCTIONS

Separating Walls

- 3.1 Based on the layout of the building, there are only two separating walls between the proposed new apartments; these are located between the Living Room of Apartment 1 and the Bedroom of Apartment 2, and between the Bathrooms of Apartments 3 and 4.
- 3.2 There are also separating walls between Apartments 2 and 4 and the neighbouring properties and these are also discussed below.

Separating Walls between Apartments

- 3.3 The separating wall construction (IWS-201) is presented on Jones Hargreaves drawings AL(0)111 and AL(0)112 and the construction consists of:

2 layers of 15mm thick British Gypsum (BG) SoundBloc each side of twin Gypframe 'C' studs braced at 1200mm centres, with 50mm thick mineral wool insulation (with a minimum density of 10kg/m³) in the cavity.
- 3.4 This construction is BG system 'A216009' which has a laboratory measured sound insulation performance of 62dBR_w. Assuming that on-site detailing is of a high standard, the proposed construction should achieve an airborne sound insulation performance of at least 45dBD_{nT,w} + C_{tr}, and therefore, meet the requirements of ADE.

Separating Walls between Apartments and Adjacent Building

- 3.5 Based on the information provided by Logan Consulting Engineers and on-site observations, it would appear that the separating walls between the development and the adjacent buildings are constructed from two leaves of brick.
- 3.6 Assuming that the combined width of the two leaves of brick is at least 220mm, then the requirement of ADE could be achieved on site. However, it would be a marginal situation depending on the internal finishes in the adjacent buildings.
- 3.7 Therefore, it is recommended that a lining consisting of a single layer of 12.5mm thick BG SoundBloc supported off a Gypframe GL1 lining channel fixed to one side, forming a cavity at least 35mm. The cavity should be filled with 25mm thick mineral wool insulation.
- 3.8 AEC recommend that achieving the requirement of ADE would be expected to demonstrate compliance with the planning condition. However, this subject to confirmation with the Local Planning Authority.

Separating Wall between Apartment and Corridor, Stairwell and Lift Shaft

- 3.9 It is understood that the existing separating walls between the apartments and the corridors, stairwells and lift shaft are constructed from concrete block. The density of the block is unknown, and the width of the walls varies throughout the development.
- 3.10 In order to meet the sound insulation requirements for these walls, the following lining (IWS-301) has been proposed by Jones Hargreaves:
- Existing block wall, lined to one side with 2 layers of 12.5mm thick BG SoundBloc supported off a Gypframe GL1 lining channel on Gypline GL9, forming an 85mm wide cavity, partially filled with 50mm mineral wool insulation.*
- 3.11 This lining is the same a BG system B226005 which should give an improvement in the airborne sound insulation performance of the wall of around +10dB.
- 3.12 However, this is based on the block wall having a minimum density of 1700kg/m³. If the block has a density significantly below this, it is recommended that an independent lining is installed instead. This would need development once the density of the block has been confirmed.

Further Considerations

- 3.13 To maintain the expected sound insulation for separating walls, the following points need to be complied with;
- Each lining to be installed with staggered joints;
 - Ensure the absorptive material within partitions and linings to be unfaced mineral wool batts or quilt (which may be wire reinforced), minimum density 10kg/m³ and covers the whole wall area;
 - Ensure there are no direct connections between the two leaves other than the acoustic braces;
 - Seal all joints in the outer layer with tape or caulk with sealant;
 - Stagger the position of sockets on opposite sides of the separating wall and use a similar thickness of cladding behind the socket box. Do not locate sockets back to back. A minimum edge to edge stagger of 200mm is recommended. Do not chase plasterboard;
 - Stairs should not be directly fixed to any separating wall.
- 3.14 Control flanking transmission from walls and floors connected to the separating wall. This would require a review of the junction details as prepared by the architect.

Internal Walls

- 3.15 The following internal wall construction is proposed:

Metal Stud Construction

One layer of 12.5mm BG SoundBloc each side of 70mm wide Gypframe.

- 3.16 This wall construction is British Gypsum system A206033 and has a laboratory measured performance of 40dBR_w, and therefore, complies with ADE.

Doors

- 3.17 Front doors of the apartments to corridors and stairwells should provide a minimum sound insulation of 29dBR_w, which could be achieved using a solid core door fitted with appropriate compressible rubber acoustic seals to the head, jambs and threshold.
- 3.18 There are no specific requirements in relation to acoustics for internal doors.

Soil Water Pipe Risers

- 3.19 ADE states that where pipes run between apartments they should be enclosed for their full height in each room.
- 3.20 The enclosure should be constructed from 2 layers of 12.5mm thick BG SoundBloc supported of an independent 'I' stud with 25mm acoustic insulation in the cavity. In addition, all pipes should be resiliently mounted.

4.0 ASSESSMENT OF FLOOR CONSTRUCTIONS

- 4.1 It is understood that there are two different base floor constructions on-site. At the front of the development in the older part of the building has a timber construction while the newer section is a concrete floor construction. The different floor constructions are discussed below.

Existing Timber Floor Construction

Separating Floor between Apartments

- 4.2 The provided information from Logan Consulting Engineers indicates that the existing timber floors are constructed from timber floorboards on timber joists and the ceiling is formed from a single layer of plasterboard.
- 4.3 In order to meet the requirements of the ADE it is recommended that the following floor construction is used between apartments 2 and 4.

- A floating floor consisting of either 1 layer of 18mm thick T&G board and 1 layer of 19mm plasterboard plank laid on top of a resilient layer (such as a layer of Regupol 3912) or a floating floor system such as such as Monafloor Deck 18;
- Existing timber floorboard, made good where required (no holes);
- Existing timber joists with 50mm mineral insulation (with a density of between 20 to 40kg/m³) laid in between;
- Ceiling formed from 2 layers of 15mm thick BG SoundBloc (or boards of equivalent mass) supported off a resilient bar.

Separating Floor between Ground Floor Retail and Apartment 2

- 4.4 The floor construction between ground floor retail unit and Apartment is unknown, therefore, measurements were undertaken by AEC on Wednesday 4 September 2019.
- 4.5 Noise level measurements were undertaken in the first-floor area around 1830 to 1900h when Kokoro was 75% occupied. During these measurements the maximum noise level in the first-floor area due to noise transfer was around NR43_{Lmax} which is 13dB above AEC's suggested noise level limit.
- 4.6 In order to improve the sound insulation performance of the separating floor to meet AEC's suggested noise level limit a floating floor should be installed on top of the existing floor in the first-floor apartment. Prior to any floating floor being installed it is recommended that the existing floorboards are taken up and mineral wool insulation (at least 100mm thick) is installed between the existing floor joists. The floorboards should be reinstated and made good, or replaced, where required.
- 4.7 The following floating floor construction should be installed on top of the existing floorboards:
- A layer of T&G floorboard at least 18mm thick;
 - A layer of dense plasterboard with a minimum mass of 13.5kg/m²;
 - FFT1/2 resilient composite deep battens, such as a Monarfloor Acoustic Cradle system, creating a cavity least 70mm between the existing floorboards and the gypsum-based board. Mineral wool insulation, at least 50mm thick with a density of at least 20kg/m³, must be laid in the cavity.
 - Existing floor-boards.
- 4.8 Controlling the maximum noise levels, due to noise transfer from Kokoro, in the apartment to below NR30_{Lmax} would comply with planning condition 6.

Existing Concrete Floor Construction

- 4.9 The thickness of the existing floor between Apartments 1 and 3 is unknown. However, it is assumed that the concrete floor slab is at least 120mm thick. Therefore, in order to achieve the airborne sound insulation performance requirements of ADE, an independent ceiling consisting of 2 layers of 15mm thick BG SoundBloc supported off a metal frame forming a cavity at least 150mm deep should be installed. The cavity should be partially filled with 100mm thick mineral wool insulation.

- 4.10 To meet the impact sound insulation performance requirements, a resilient layer with a reduction in impact sound insulation performance of at least $17\text{dB}\Delta L_w$ (delta L_w) should be installed beneath any rigid floor finish. A resilient layer would not be required under the majority of carpets, however, AEC should check the carpet before installation.

5.0 ASSESSMENT OF THE INTERNAL FINISHES

- 5.1 In order to meet the requirements of Part E3 of ADE, the reverberation time in all common areas (e.g. lobbies, stairwells) should be controlled to a reasonable level. This is usually achieved by adding an absorptive ceiling and carpet to all common areas.
- 5.2 The ceiling should be at least absorption Class C. Alternatively, acoustically absorbent wall panels could be considered.
- 5.3 However, based on similar previous projects AEC has worked on, Building Control departments often accept the inclusion of carpets only as a suitable method for controlling reverberation times in the corridors and stairwells. This will need to be confirmed with the Building Control department.

APPENDIX A – Acoustic Terminology in Brief

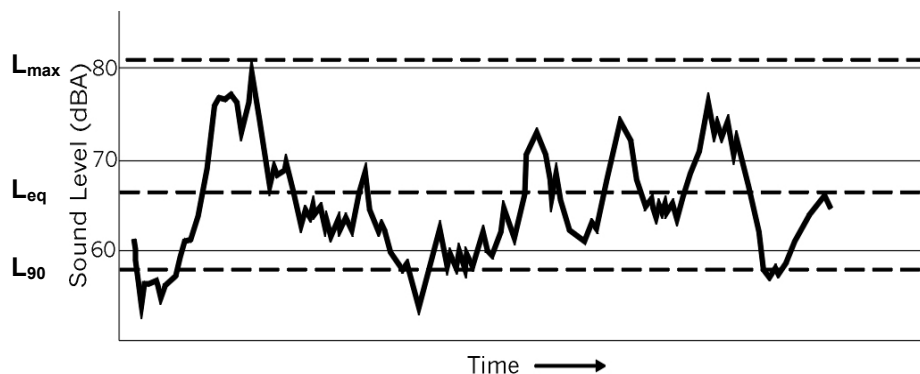
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most sound is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The dBA weighting emphasises or reduces the importance of certain frequencies within the audible range.

Sound Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the sound.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of sound can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be preceded by a dB descriptor in the report e.g. $L_{Aeq,T}$ could be written $dBL_{Aeq,T}$



Example of Sound Level Varying With Time

- | | |
|-------------|---|
| $L_{Aeq,T}$ | The equivalent continuous (A-weighted) sound level. It may be thought of as the "average" sound level over a given time, T. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the "ambient" noise level. |
| $L_{A10,T}$ | The (A-weighted) sound level exceeded for 10% of a measurement period. It is the value often used to describe traffic noise. |

L_{A90}	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise.
L_{Amax}	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
Façade Level	This refers to the sound level measured outside, at 1m from a hard reflecting surface, typically 3dB greater than the free-field level.

Other Acoustics Units

NRC	Noise reduction coefficient – a single figure number sometimes used to describe the performance of sound absorbing materials based on a combination of its absorption coefficient at various frequencies.
NR	Noise rating – a graphical method for assigning a single number rating to a noise spectrum and is often used to specify noise level limits for mechanical services.
R_w	Sound reduction index - single number rating used to describe the <u>laboratory</u> airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
D_w	Single number rating used to describe the on-site airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
D_{nT,w}	Single number rating used to describe the on-site airborne sound insulation performance properties of a material or building element over a range of frequencies, typically 100-3150Hz, which is calculated in terms of a standardized reverberation time of 0.5 seconds.
C_{tr}	A road traffic spectrum adaptation term which is referenced to demonstrate the to the low frequency sound insulation performance of building elements.
L'_{nT,w}	Single number rating used to describe the on-site impact sound insulation performance properties of a floor over a range of frequencies, typically 100-3150Hz, which is calculated in terms of a standardized reverberation time of 0.5 seconds.
RT	The RT (Reverberation Time) of a space is defined as the time it takes for the sound pressure level to reduce by 60dB. It is not always possible to measure the full 60dB decay, so the first 20dB decay (T ₂₀) or 30dB decay (T ₃₀) is used to approximate the reverberation time (T ₆₀)