



AH2 DEVELOPMENTS

2 REGENT STREET, WREXHAM

ACOUSTIC DESIGN REPORT

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1.0 INTRODUCTION

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by ah2 Developments to undertake an acoustic design review of the proposals for the conversion of the existing storage spaces on the second and third floors of 2 Regent Street, Wrexham, into six apartments.
- 1.2 The ground and first floor of the building will be retained as commercial space at this stage, with the first floor continuing to be used as a storage area for the ground floor charity shop.
- 1.3 This report provides a summary of the relevant acoustic design criteria, based on the requirements of Approved Document E '*Resistance to the passage of sound*' (ADE), 2003 edition (incorporating 2004 amendments) which is an approved publication for the purposes of The Building Regulations 2010.
- 1.4 Acoustic terminology is discussed in brief in Appendix A.

CDM Regulations

- 1.1 AEC assumes that the lead designer, contractor and client are aware of their requirements under the CDM regulations 2015.
- 1.2 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. The final specifications for construction materials and methods would be prepared by others and any potential health and safety issues associated with the use of specific construction materials and/or methods must be confirmed based on all available information including that from the manufacturer and/or supplier.
- 1.3 Some of the risks associated with the use of materials commonly suggested for acoustic design purposes and certain construction methods could include:
 - manual handling of heavy blockwork and boards;
 - handling of hazardous substances such as mineral wool, which can be an irritant and the appropriate protection should be worn during its use;
 - noisy construction works, where quieter alternatives should be used and protection provided to site operatives where necessary.
- 1.4 As the development is for residential units, there are no concerns relating to potentially high noise level exposure of future occupants.

2.0 ACOUSTIC DESIGN CRITERIA

General

- 2.1 The internal acoustic design of this scheme is based on the acoustic requirements detailed in ADE. The requirements for residential developments are presented in the following parts:

- 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 flats formed by material change of use are presented in Table 2.1, below:

Table 2.1 – Sound Insulation Performances Required for Separating Wall, Floors and Stairs

Separating Structures (Change of Use)	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 minimum airborne performances presented in Table 2.1 should also be achieved between dwellings and any other part of the same building. Where activities in adjacent non-residential spaces are likely to result in elevated noise levels, higher sound insulation performances may be required, and these are discussed below.
- 2.4 To demonstrate compliance with ADE, a proportion (10%) 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 at least 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 walls between a bedroom or a room containing a water closet, and other rooms and internal floor constructions within houses, flats and rooms for residential purposes 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 tested on site.
- 2.7 It should be noted that Part E2 does not apply in the following instances:
- an internal wall containing a door;
 - an internal wall which separates an en-suite toilet from the associated bedroom.

Part E3

- 2.8 In addition to the above sound insulation performance standards, a further requirement of ADE 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.

Noise Transfer from Non-Residential Spaces

- 2.9 The required minimum airborne sound insulation performance for the separating floor presented in Table 2.1, above, would be suitable for controlling noise transfer between the ground floor charity shop and the storage area on the first floor and the apartments above.

3.0 ASSESSMENT OF WALL CONSTRUCTIONS

- 3.1 Based on the drawings provided by Paul Hughes Architects, all the separating walls between the flats will be formed from existing masonry walls and new build drylining partitions will be constructed as internal walls. These are discussed separately below.

Existing Separating Masonry Walls

- 3.2 Further to a site survey undertaken by Paul Hughes, it is understood that the width of the separating walls range in thickness from 220 to 390mm.
- 3.3 Based on AEC's experience, solid masonry walls around 300mm thick should meet the requirements of ADE. However, it is recommended that an airborne sound insulation test is carried out on the existing separating wall being retained at the earliest opportunity.
- 3.4 Regarding the 220mm thick walls (and separating walls <300mm), it is recommended that these are lined on one side with a layer of 12.5mm thick British Gypsum (BG) SoundBloc (or board of similar density) supported off a Gypframe GL1 lining channel (or similar) creating a cavity 35mm wide. The cavity should be partially filled with 25mm thick mineral wool insulation.
- 3.5 Any existing doorways or other openings should be infilled using either:
- Two leaves of 100mm masonry (at least 1500kg/m³), or
 - Twin timber stud wall, set at least 50mm apart, and finished to both sides with two layers of 15mm thick dense plasterboard (such as BG SoundBloc), with 100mm thick mineral wool insulation in the cavity.

- 3.6 This may need further development with input from an acoustician to ensure appropriate detailing.

Internal Walls

- 3.7 Example metal and timber stud constructions that would meet the requirements of ADE are presented below:

Metal Stud Construction

One layer of 12.5mm BG SoundBloc each side of 48mm wide Gypframe C studs at 600mm centres with 25mm mineral wool insulation in the cavity.

- 3.8 This wall construction is BG system A206033 and has a laboratory measured performance of 40dBR_w.

Timber Stud Construction

One layer of 12.5mm BG SoundBloc each side of 63mm wide timber studs at 600mm centres with 25mm mineral wool insulation in the cavity.

- 3.9 This wall construction is BG system A026009 and has a laboratory measured performance of 40dBR_w.

Doors

- 3.10 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 compression rubber compression acoustic seals to the head, jambs and threshold.
- 3.11 There are no specific requirements in relation to acoustics for internal doors.

Further Considerations

- 3.12 To maintain the expected sound insulation for separating walls, the following points need to be complied with (not an exhaustive list);
- 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;
 - Seal all joints in the outer layer with tape or caulk with sealant;
 - Stagger the position of sockets on opposite sides of the wall (on both internal and separating walls) and use a similar thickness of cladding behind the socket box. As a minimum, the aims should be to install socked boxes in adjacent stud bays;
 - Stairs should not be directly fixed to any separating wall.
- 3.13 Any potential noise flanking transmission via the walls and floors connected to the separating wall will need to be controlled. This would require a review of the junction details as prepared by the architect.

4.0 ASSESSMENT OF FLOOR CONSTRUCTIONS

- 4.1 The separating floor between the first and second floors is currently constructed from timber floorboards on timber joists with a lath and plaster ceiling underneath. The same construction has been used between the second and third floors, however, there are areas where the ceiling has been removed. In addition, there is a ceiling light between the second and third floor.
- 4.2 It is understood that a Collecta DECKfon 26T overlay board will be installed on top of the existing floorboards throughout. There are three different ceiling scenarios and these are discussed below.

Retained the Lath and Plaster Ceiling

- DECKfon 26T floating floor, sealed at the perimeter with YELOfon FS30;
- Existing floorboards or at least 18mm chipboard/plywood;
- Existing timber joists;
- Lath and plaster ceiling;
- Two layers of 15mm thick BG SoundBloc, set at least 100mm below the lath and plaster ceiling, supported off a MF system. 100mm thick mineral wool insulation (minimum density of 45kg/m³) laid in the cavity.

Existing Floor Timber Floorboards and Joists Only

- DECKfon 26T floating floor, sealed at the perimeter with YELOfon FS30;
- Existing floorboards or at least 18mm chipboard/plywood;
- Existing timber joists;
- Two layers of 15mm thick BG SoundBloc, supported off 16mm thick standard resilient bars mounted at right angle to the joists, set at 400mm centres 100mm thick mineral wool insulation (minimum density of 45kg/m³) laid in the cavity.

Rooms with both Lath and Plaster Ceiling and Exposed Existing Joists

- 4.3 In these locations the lath and plastered areas will be underdrawn as presented above. Where the lath and plaster has been removed, the ceiling will be supported off Collecta AH50 acoustic hangers to ensure the ceiling height will be the same throughout.

Ceiling Light

- 4.4 The ceiling light in the floor between the second and third floors should be filled in using the Collecta floor construction presented above. If this is not possible, we would need to discuss alternatives with the architect and contractor. Some further consideration would need to be given to the detailing of this to ensure there are no weakness where the infill section meets the existing structure.

Further Considerations

- 4.5 It was noted that there is a chimney stack that runs between floors. It is important that this is blocked up and/or boxed in, and is not a noise flanking path. Currently the chimney breast on two floors are partially bricked up. This will need to be reviewed once the design for these has been determined.
- 4.6 Due to the thickness of the walls, and wall linings in some areas, it is expected that noise flanking via the continuous walls between the apartments will be suitably controlled. However, it is recommended that a preliminary test is undertaken at the earliest opportunity.
- 4.7 Any service penetrations through the floor would need to be suitably sealed and boxed in with two layers of 15mm thick BG SoundBloc on an independent metal or timber frame and loosely filled with mineral wool insulation. This will require development once the locations of the services have been determined.

5.0 ASSESSMENT OF THE INTERNAL FINISHES

- 5.1 To achieve the requirements of Part E3 of ADE for entrance halls and corridors an area equivalent to or greater than the floor area should be covered in a Class C (or better) acoustic absorber.
- 5.2 The amount of sound a specific material absorbs at each octave frequency band and its classification is defined in BS EN ISO 11654:1997 '*Acoustics – Sound absorbers for use in buildings – Rating of sound absorption*' (BS11654). BS11654 provides a class range from A to E, with A, providing the highest amount of practical sound absorption coefficient for each octave band.
- 5.3 For corridors the Class C absorber can be in the form of a carpet, with any additional absorption that is necessary installed on the ceiling. For entrance halls this would normally be provided at soffit level. However, relaxations are often sought from building control in relation to communal areas that don't contain apartment entrance doors.
- 5.4 In relation to stairwells, an area equivalent to the total calculated area of the stair treads, the upper surface of the intermediate landings, the upper surface of the landings (excluding the ground floor) and the ceiling area of the top floor should be fitted with a Class D acoustic absorber.
- 5.5 This could be achieved using an appropriate carpet in these areas. Alternatively, an area equivalent to 50% (or greater) of the total calculated area can be covered with a Class C absorber. It is important that the absorption is evenly distributed between all floors. This would be subject to Building Control approval.

APPENDIX A – Acoustic Terminology in Brief

Sound Description

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.

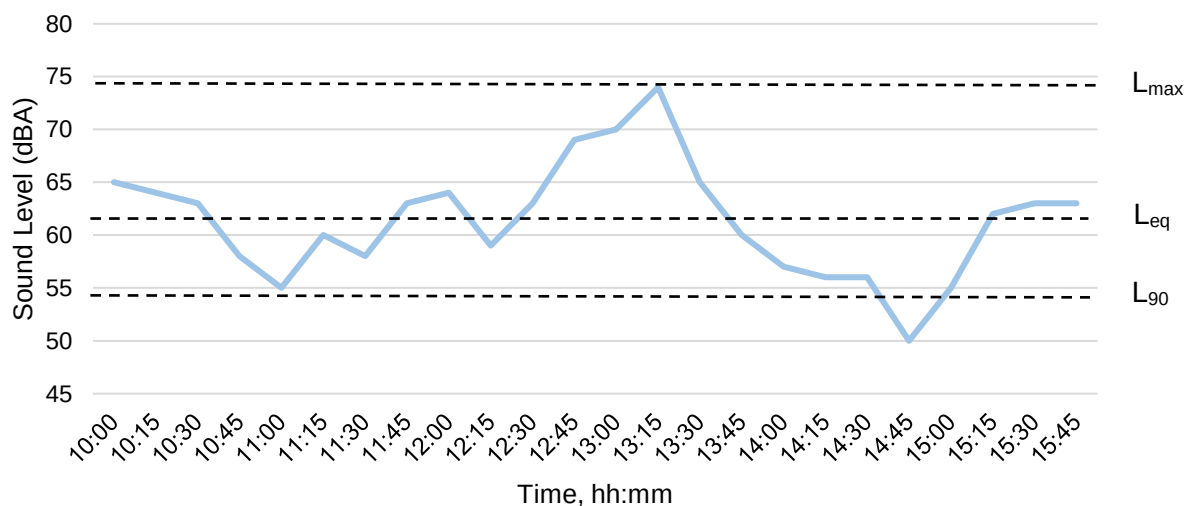
The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The dBA weighting emphasises or reduces the importance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



Unit Type	Acoustic Unit	Description
Sound reduction index	R_w	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.
A road traffic spectrum adaptation term	C_{tr}	Referenced to demonstrate the to the low frequency sound insulation performance of building elements. Makes reference to the A-weighted urban traffic noise spectrum.
Weighted standardized level difference	$D_{nT,w}$	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.
Element normalized level difference	$D_{n,e,w}$	Single number rating used to describe the sound insulation performance of small elements.
Flanking normalized level difference	$D_{n,f,w}$	Single number rating used to describe the sound insulation performance.
Reverberation Time	RT	The time taken 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}).