

18 Silver Street, Durham

Acoustic performance standards & design strategy for planning

8461.1

9th December 2020

Revision A



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Contents

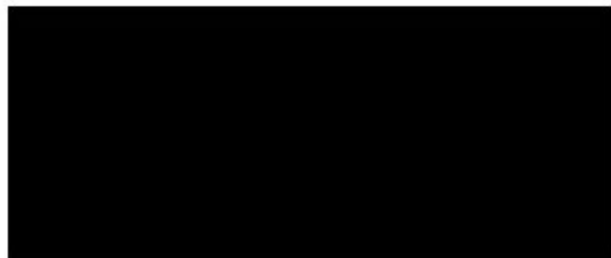
Contents.....	2
1 Summary	3
2 Introduction.....	4
Section A – Acoustic Performance Standards	5
3 Planning policy and noise criteria	6
4 Building Regulations 2010, Approved Document E 2003	7
Section B – Acoustic Design Strategy	8
5 Building envelope sound insulation assessment	9
6 Approved Document E assessment.....	11
7 Conclusion	13
8 References.....	14

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1 Summary

- 1.1 This report relates to the proposed scheme of work at 18 Silver Street, Durham.
- 1.2 It details the performance requirements relating to the scheme and outlines the way in which they may be achieved.
- 1.3 The performance requirements relate to those agreed with Durham City Council for indoor noise levels and internal sound insulation between the retail unit and proposed residential properties.
- 1.4 Table 1 shows the sound insulation requirements for façade elements.

Table 1: Summary of minimum façade element sound insulation requirements			
Elevation	Glazing performance	Trickle ventilator performance	Potential AD-F ventilation strategy
All elevations	36 dB $R_w + C_{tr}$ e.g. Guardian 6/16/8.4 (44.1) Or where existing glazing is retained secondary pane of 6 mm separated by 100 mm	[Trickle vent not required]	AD-F System 3, MEV with a design air permeability of $> 5 \text{ m}^3/\text{h}/\text{m}^2$

- 1.5 Table 2 shows sound insulation requirements for separating and internal constructions.

Table 2: Summary of recommended element specifications		
Requirement	Specification (BG reference)	
Requirement E1 43 dB $D_{nT,w} + C_{tr}$	New partitions	<p>Option A (A316009)</p> <ul style="list-style-type: none"> 70 mm metal C-stud OR 75 mm x 38 mm timber stud at c600 mm 50mm mineral wool, $\geq 24 \text{ kg}/\text{m}^3$ e.g. Isover APR1200 within Resilient bar both sides, e.g. BG RB1 2 x 15 mm BG SoundBloc both sides <p>Option B (A206A291S)</p> <ul style="list-style-type: none"> 92 mm acoustic stud at c600 mm 50mm mineral wool, $\geq 24 \text{ kg}/\text{m}^3$ e.g. Isover APR1200 within 2 x 12.5 mm BG SoundBloc both sides <p>Option C</p> <ul style="list-style-type: none"> 215 mm dense block (min. $1950 \text{ kg}/\text{m}^3$) laid flat Parge coat or render both sides
	Level 01 floor Between retail and residential	<ul style="list-style-type: none"> Repair and seal all gaps in existing floor boards Overboard the existing ceiling to $20 \text{ kg}/\text{m}^2$, e.g. with 1 x 19 mm Gyproc Plan, or 2 x 12.5 mm WallBoard Additional MF ceiling below to provide minimum 150 mm void between existing ceiling and new ceiling 100mm mineral wool, $\geq 24 \text{ kg}/\text{m}^3$ e.g. Isover APR1200 within void 2 x 12.5 mm BG SoundBloc

2 Introduction

- 2.1 This report has been prepared in support of a proposed change of use scheme at 18 Silver Street, Durham.
- 2.2 The development consists of the conversion of the upper floors and part conversion of the ground floor from retail to residential use.
- 2.3 This report provides details of recommendations for how the proposed scheme may comply with:
- Requirements for building envelope sound insulation agreed with the Local Planning Authority. (detailed in Section 5), and internal sound insulation between the residential areas and ground floor retail use (detailed in Section 6)
- 2.4 The approximate location of the site is shown in Figure 1.

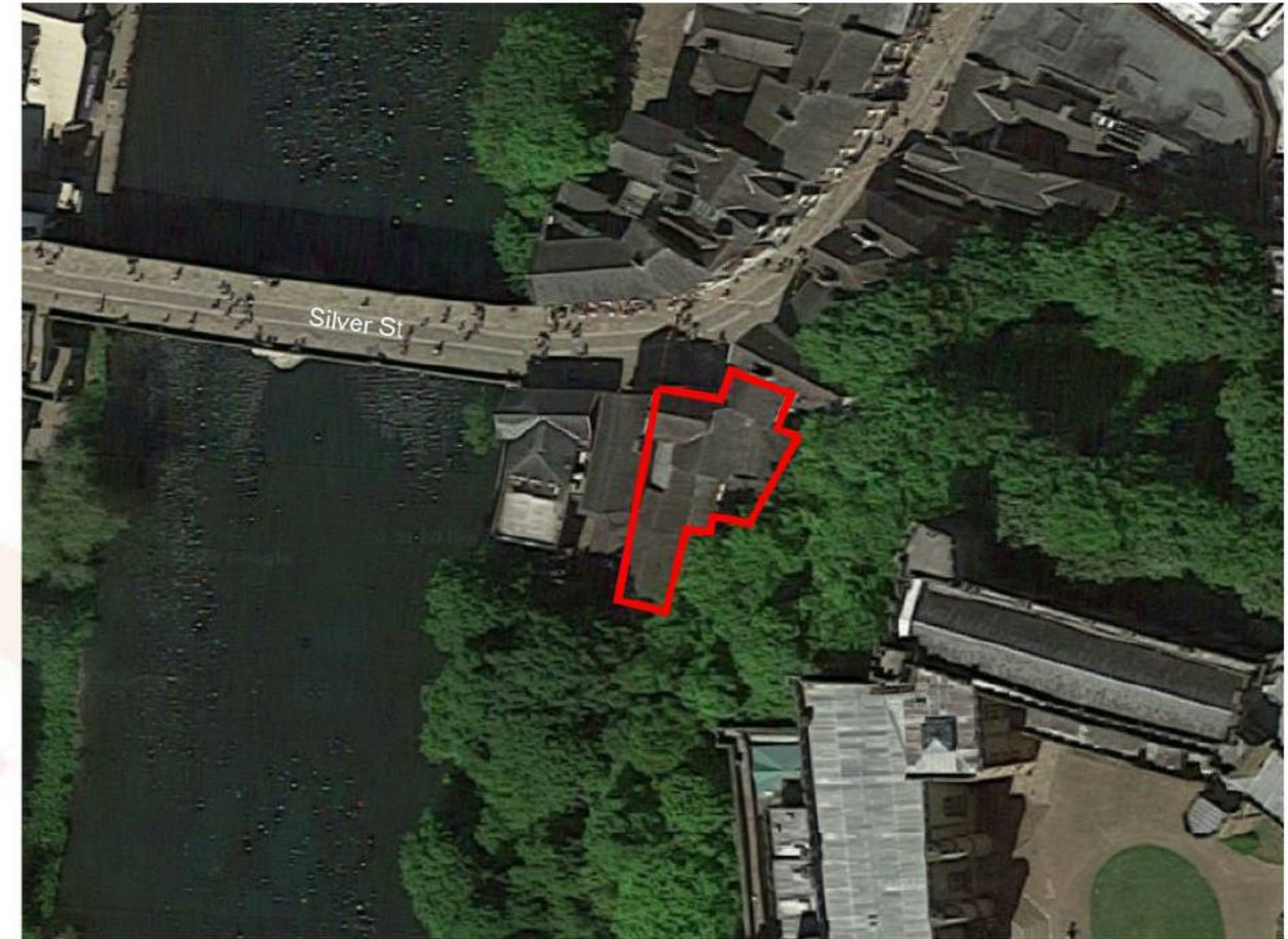
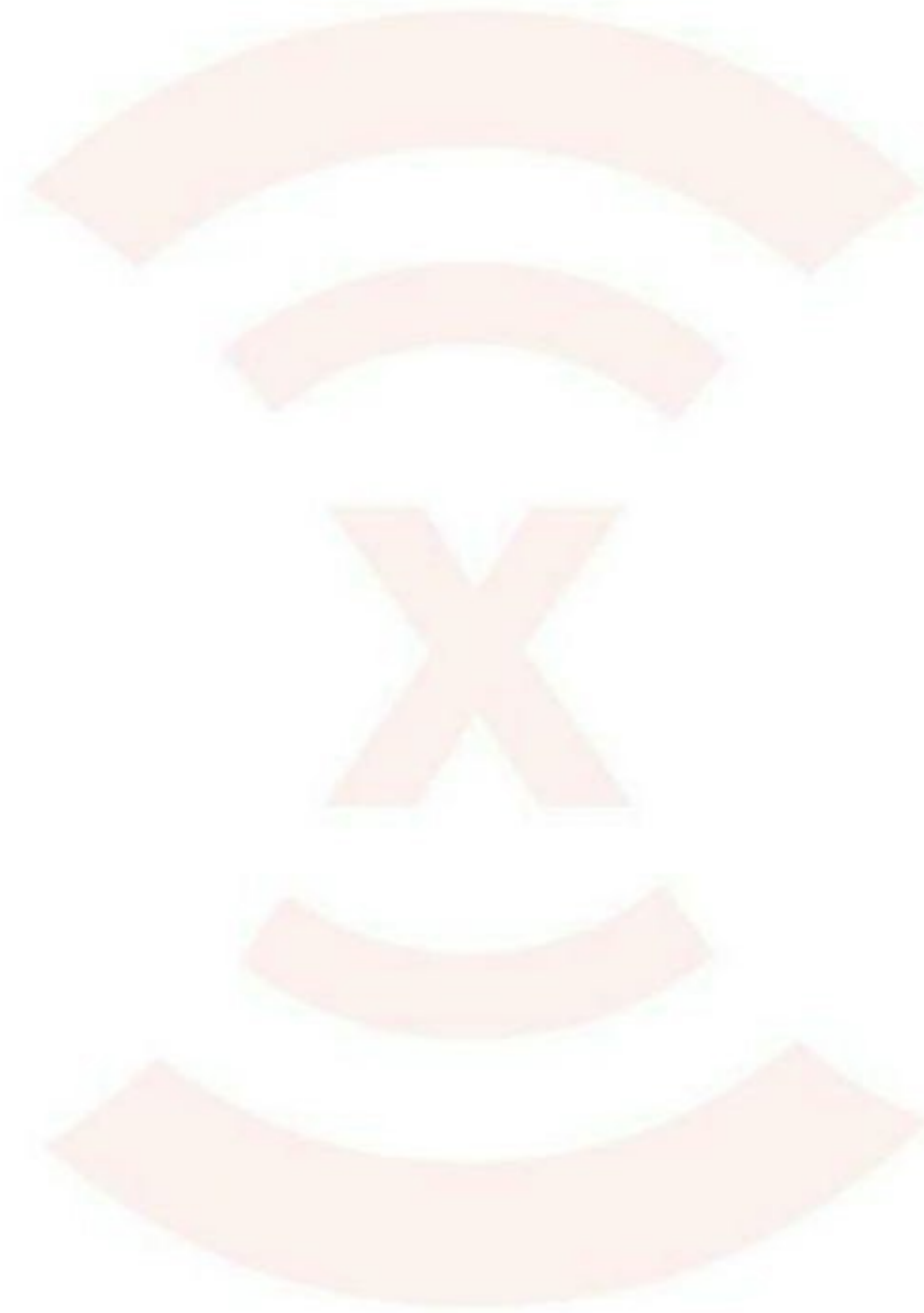


Figure 1: Site location on Silver St, outlined in red



Section A – Acoustic Performance Standards

This section outlines the acoustic performance standards adopted for this development.



3 Planning policy and noise criteria

3.1 National Planning Policy Framework (NPPF)

3.2 The National Planning Policy Framework (NPPF) Reference 1, sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. In respect of noise, Paragraph 170, 180 and 182 of the NPPF states the following:

3.3 Paragraph 170:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution..."

3.4 Paragraph 180:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; ... "

3.5 Paragraph 182:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

3.6 Noise Policy Statement for England (NPSE)

3.7 The Noise Policy Statement for England, Reference 2, states three policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;

- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

3.8 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- Lowest Observed Adverse Effect Level (LOAEL)
This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
This is the level above which significant adverse effects on health and quality of life occur

3.9 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.10 It is considered that meeting the internal noise level limits given in BS 8233, which are in line with those given by the World Health Organisation, Reference, adequately achieve the first and second aims of the NPSE.

3.11 Local planning authority consultation and guidance

3.12 Durham City Council has been consulted regarding their requirements for methodology and criteria. The following approaches and criteria are proposed for this development based on discussions and correspondence with John Hayes, Principal Public Protection Officer at the city's Public Protection Service:

- Current restrictions on the operation of hospitality venues and some retail owing to the Coronavirus pandemic mean that activity and therefore noise levels arising on Silver Street are not considered representative of normal.
- Use of representative existing data for Durham city centre in the building envelope noise assessment is acceptable. Apex will use archive data for noise levels measured on Saddler Street, as a prudent approach. These noise levels are shown in 5.7
- Assessment should be undertaken to achieve internal noise level criteria given in BS 8233, Reference 3, reproducing the guideline levels of the WHO, Reference 4.

- Sound insulation between the adjacent retail uses and the residential uses should meet the criteria of AD-E for residential formed by material change of use. (expanded on in Section 4).

3.13 The WHO and BS 8233 criteria for internal noise levels are shown in Table 3.

Table 3: Internal noise level criteria				
Activity	Location	Guideline limit, dB		
		$L_{Aeq,daytime}$	$L_{Aeq,night-time}$	L_{AFmax}
Resting	Living room	35	-	-
Dining	Dining room	40	-	-
Sleeping (daytime resting)	Bedroom	35	30	45

3.14 With regard to the night-time L_{AFmax} criterion, it is normally considered that this limit may be exceeded up to 10 times per night while maintaining amenity with regard to internal noise.

4 Building Regulations 2010, Approved Document E 2003

4.1 AD-E Requirement E1

4.2 An excerpt from AD-E outlining Requirement E1 is shown in Figure 2.

4.3 For this development, Requirement E1 is applicable to:

- Separating wall airborne sound insulation – Partition between ground floor retail and proposed ground floor residential;
- Separating floor airborne sound insulation – Floor between ground floor retail and proposed first floor residential;

4.4 Para. 0.1 of AD-E states that:

“in the Secretary of State’s view the normal way of satisfying Requirement E1 will be to build separating walls, separating floors, and stairs that have a separating function, together with associated flanking construction, in such a way that they achieve the sound insulation values for dwelling-houses and flats as set out in Table 1a, and the values for rooms for residential purposes (see definition in Regulation 2) set out in Table 1b”

4.5 The sound insulation performance standards to satisfy Requirement E1 for “dwelling-houses and flats formed by material change of use / rooms for residential purposes formed by material change of use” are shown in Figure 3.

Protection against sound from other parts of the building and adjoining buildings

E1. Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.

Figure 2: Excerpt of Requirement E1 from AD-E

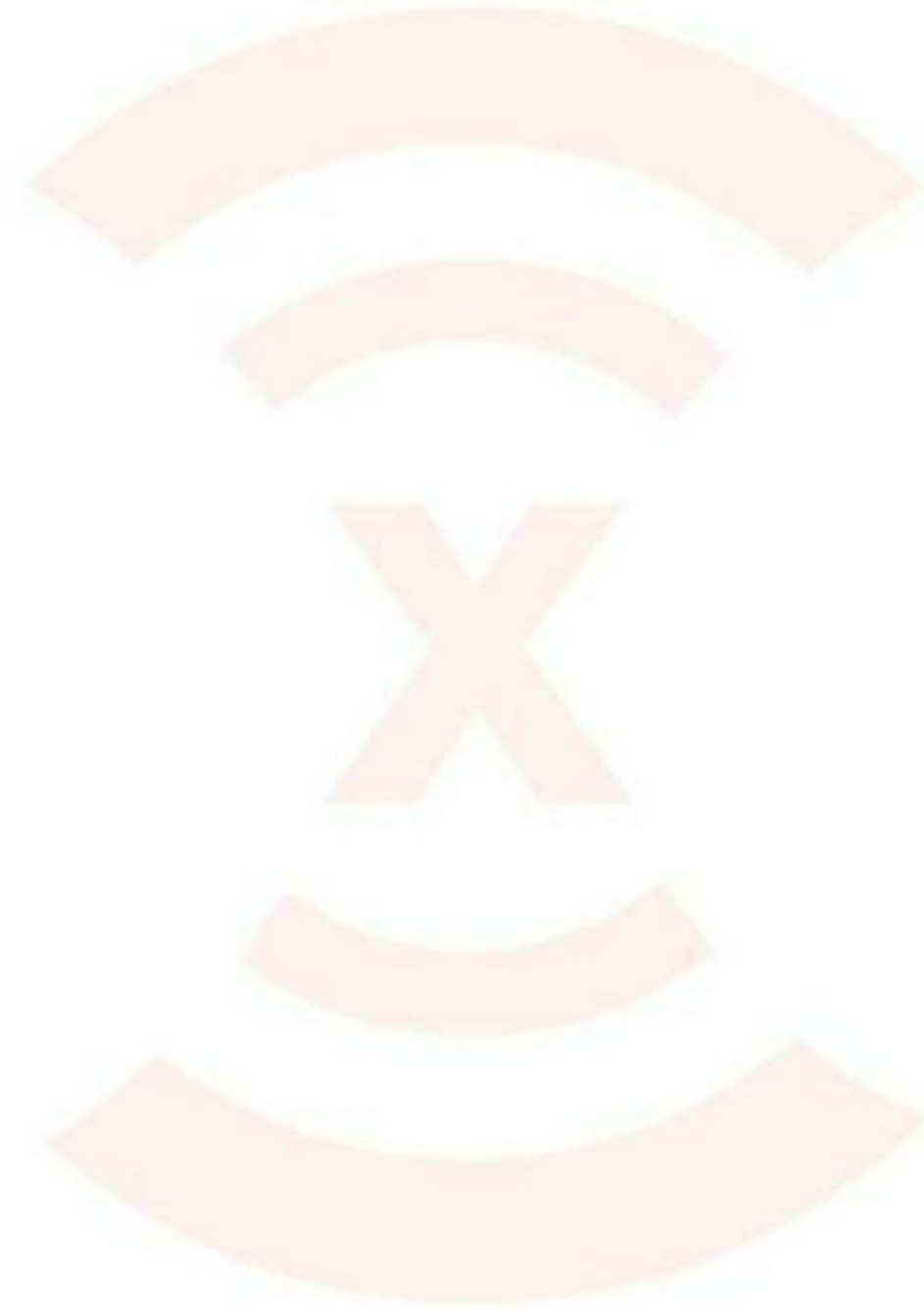
Table 0.1a Dwelling-houses and flats – performance standards for separating walls, separating floors, and stairs that have a separating function		
	Airborne sound insulation sound insulation $D_{nT,w} + C_v$ dB (Minimum values)	Impact sound insulation $L'_{nT,w}$ dB (Maximum values)
Purpose built dwelling-houses and flats		
Walls	45	-
Floors and stairs	45	62
Dwelling-houses and flats formed by material change of use		
Walls	43	-
Floors and stairs	43	64

Figure 3: Excerpt of Secretary of States view for the normal way for satisfying Requirement E1 for dwelling-houses and flats



Section B – Acoustic Design Strategy

This section provides guidance on the way that the requirements detailed in Section A may be achieved in practice.



5 Building envelope sound insulation assessment

5.1 Measurements

- 5.2 As described in Section 3.12, Apex agreed with Durham CC that existing data was to be used as the basis for a noise break-in assessment.
- 5.3 Apex conducted a review of noise data provided for other planning applications for similar schemes in Durham city centre. Data gathered by Apex for a planning application on Saddler Street was considered to be a prudent basis for the assessment.
- 5.4 Apex undertook façade noise measurements on Saddler Street over a weekend period from Friday 14th June to Monday 17th June 2019.
- 5.5 Use of this data for assessment of Silver St is considered prudent on the basis that Silver St. features predominantly retail uses, as opposed to the more common hospitality use on Saddler St.
- 5.6 The noise levels used are most significantly produced by pedestrians and people using the hospitality venues.
- 5.7 **Noise levels used**
- 5.8 Table 4 shows the noise levels used in the building envelope assessment.

Table 4: Measured A-weighted façade noise levels									
Parameter	dB(A)	Octave band centre frequency, Hz							
		Measured A-weighted noise levels, dB							
		63	125	250	500	1k	2k	4k	8k
Daytime, $L_{Aeq, 16 \text{ hr}}$	65	37	48	52	60	61	58	52	43
Night time, $L_{Aeq, 8 \text{ hr}}$	67	38	44	56	62	63	60	54	48
Night time, L_{AFmax}	89	-	-	-	-	-	-	-	-

- 5.9 The L_{AFmax} noise levels presented are the tenth highest during the night time assessment period.

5.10 Potential impacts with windows open

- 5.11 Based on a 13 dB difference between external free-field noise levels and internal noise levels through a partially open window, the SOAEL is calculated to be exceeded.
- 5.12 The required façade sound insulation of the development is therefore considered with windows closed, and alternative provision should be made for background ventilation and control of overheating.
- 5.13 Opening windows may still be acceptable to provide purge ventilation as described by Approved Document F (AD-F), Reference 5, given that the activities requiring purge ventilation are typically short in duration, such as painting and decorating, or removing smoke from burning toast.
- 5.14 Overheating has traditionally been controlled using opening windows but is not controlled under the Building Regulations.
- 5.15 **Ventilation strategy**
- 5.16 The proposed development will be required to meet Part F of the Building Regulations with regard to ventilation provision, as described in AD-F.
- 5.17 It is not considered feasible for trickle ventilators to be used where existing glazing or window units are retained.
- 5.18 A suitable ventilation strategy may be AD-F System 3 (continuous mechanical extract (MEV)).
- 5.19 Per Table 5.2c of AD-F, where the designed air permeability of the scheme is greater than 5 m³/h/m² at 50 Pa, background ventilators are not necessary.
- 5.20 Para 5.10 of AD-F goes on to recommend that
“this option is selected only if designing to an air permeability leakier than 5 m³/h/m² and if the person carrying out the building work has previous experience of closely matching design with as-built air permeability levels.”
- 5.21 It should be emphasised that the above is not intended to constitute a ventilation strategy design, which is the responsibility of the mechanical engineers.
- 5.22 Once the ventilation strategy is established, if the details vary from those described above, the proposed details should be reassessed for acoustic performance.
- 5.23 Ventilation system design should be carefully considered. Research has shown that annoyance caused by noise from poorly designed systems frequently results in occupants curtailing the operation of the ventilation system. Such action leads to inadequate ventilation resulting in poor air quality, which is well correlated with a range of adverse health effects.

5.24 **Façade sound insulation calculations**

- 5.25 The minimum glazing performances presented in the summary table are calculated to be required to reduce noise levels to below the LOAEL for internal noise levels in those rooms most exposed to external noise ingress.
- 5.26 Noise levels in less exposed but similarly protected rooms will be lower and therefore also comply with the internal noise level targets.
- 5.27 The most exposed rooms are those with the largest ratio of window area to room volume, as well as those closest and most exposed to the noise sources.
- 5.28 The calculation method for façade sound insulation is in accordance with BS 8233 and the principles of BS EN 12354-3, Reference 6.
- 5.29 From ISO 16283, Reference 7, the reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room. This value is used for both living rooms, bedrooms and studio apartments
- 5.30 Details of the methodology used to calculate internal noise levels are provided on our website. Full façade sound insulation calculations are available on request.
- 5.31 The room and window dimensions used in the calculations are taken from the architects' plans and elevations, Reference 0.
- 5.32 The sound reduction of the masonry portion of the facade is much higher than that of the glazing and ventilation provision. Therefore, noise penetration through the masonry is regarded as relatively insignificant.
- 5.33 Calculated internal noise levels based on manufacturer's test data for the example glazing and ventilation products listed in the summary table are presented in Table 6.

Table 5: Measured A-weighted façade noise levels				
Façade affected	Room affected	Calculated internal level		
		Daytime dB $L_{Aeq,16hr}$	Night time dB $L_{Aeq,8hr}$	Night time dB L_{AFmax}
All elevations	Bedroom Living Room Studios	19	20	45

Table 6: Summary of calculated worst-case internal noise levels

- 5.34 The internal maximum noise level has been calculated based on the 10th highest maximum noise level measured during the night-time, which was caused by pedestrians. Based on the proposed façade sound insulation provision and the level and frequency of the measured maximum noise events, 45 dB L_{AFmax} is likely to be exceeded at most 9 times, and is therefore below the LOAEL described in paragraph 3.14.

6 Approved Document E assessment

6.1 Requirement E1 construction options

6.2 New separating partition without a door

6.3 Based on a lightweight partition type it is calculated that a minimum laboratory performance of ≥ 51 dB $R_w + C_{tr}$ is required.

6.4 The following constructions shown in Table 7 may achieve the performance standards to satisfy Requirement E1 partitions:

Table 7: Summary of recommended E1 element specifications	
Requirement	Specification (BG reference)
Requirement E1 43 dB $D_{nT,w} + C_{tr}$	<p>New partitions</p> <p>Option A (A316009)</p> <ul style="list-style-type: none"> 70 mm metal C-stud OR 75 mm x 38 mm timber stud at c600 mm 50mm mineral wool, ≥ 24 kg/m³ e.g. Isover APR1200 within Resilient bar both sides, e.g. BG RB1 2 x 15 mm BG SoundBloc both sides <p>Option B (A206A291S)</p> <ul style="list-style-type: none"> 92 mm acoustic stud at c600 mm 50mm mineral wool, ≥ 24 kg/m³ e.g. Isover APR1200 within 2 x 12.5 mm BG SoundBloc both sides <p>Option C</p> <ul style="list-style-type: none"> 215 mm dense block (min. 1950 kg/m³) laid flat Parge coat or render both sides

6.5 Penetrations of/through an E1 wall

6.6 All service penetrations through E1 partitions must be appropriately sealed. In practice this is the aspect that most often and significantly degrades the sound insulation performance on site.

6.7 All voids around the service penetration should be packed with quilt and the penetrations should have two layers of plasterboard, equivalent to the wall linings, scribed around the services to within no more than 20 mm and sealed all around with acoustic mastic, overlapping the plasterboard partition by at least 50 mm if surface mounted.

6.8 If ductwork penetrates the separating wall from a corridor or other adjoining areas, crosstalk attenuators are required. These should be mounted directly adjacent to the partition, and ductwork should be boxed in with two layers of 12.5 mm SoundBloc, with 50 mm APR 1200 within boxing and all joints sealed with acoustic mastic.

6.9 Pattresses for heavy fixtures to the side with the resilient bar may undermine the performance of the resilient bar, and a pattress should be avoided to this side of the partition where possible; please advise if pattresses are required for fixings.

6.10 Where sockets are proposed to the separating wall, these should not be back to back, but staggered by at least 450 mm and may be treated with equivalent plasterboard linings behind to the penetrated partition lining.

6.11 Prefabricated socket boxes, or intumescent lining pads that have been tested acoustically to maintain the acoustic integrity of the wall may be used for convenience. Potential suppliers may include:

- Acoustic and intumescent putty pads, such CP 617 from www.hilti.co.uk
- Intumescent putty pads from www.envirograf.com
- SRS Acoustic Socket Box, www.soundreduction.co.uk

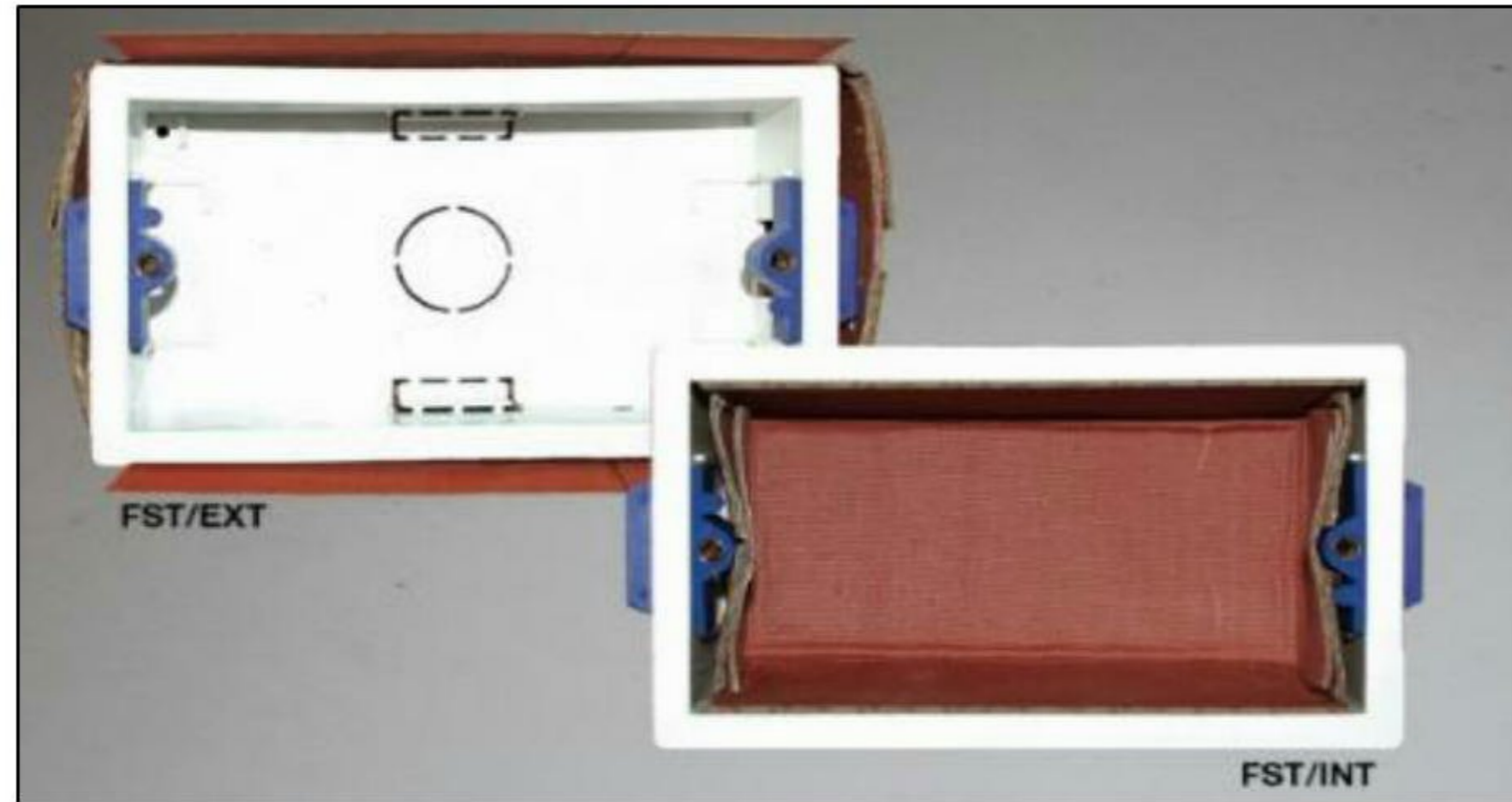


Figure 4: Envirograf intumescent putty pad

6.12 **Flanking transmission via walls**

6.13 A plasterboard lining to an external wall or internal plasterboard partitions should not be continuous past a separating E1 partition.

6.14 Continuous masonry (< 350 kg/m²) past an E1 separating floor or wall can cause a failure due to flanking noise transmission. If any masonry flanking elements are identified as being < 350 kg/m² they should be lined per the recommendations of Table 7.

6.15 Details of the existing construction are required to provide guidance on specific designs.

6.16 **Separating floors**

6.17 Based on a lightweight timber joist floor, it is calculated that a minimum laboratory performance of $\geq 51 \text{ dB } R_w + C_{tr}$ is required.

6.18 The floor construction should also satisfy the impact sound criteria of $\leq 64 \text{ dB } L'_{nT,w}$.

6.19 The following construction may satisfy the performance standards to satisfy Requirement E1 between floors:

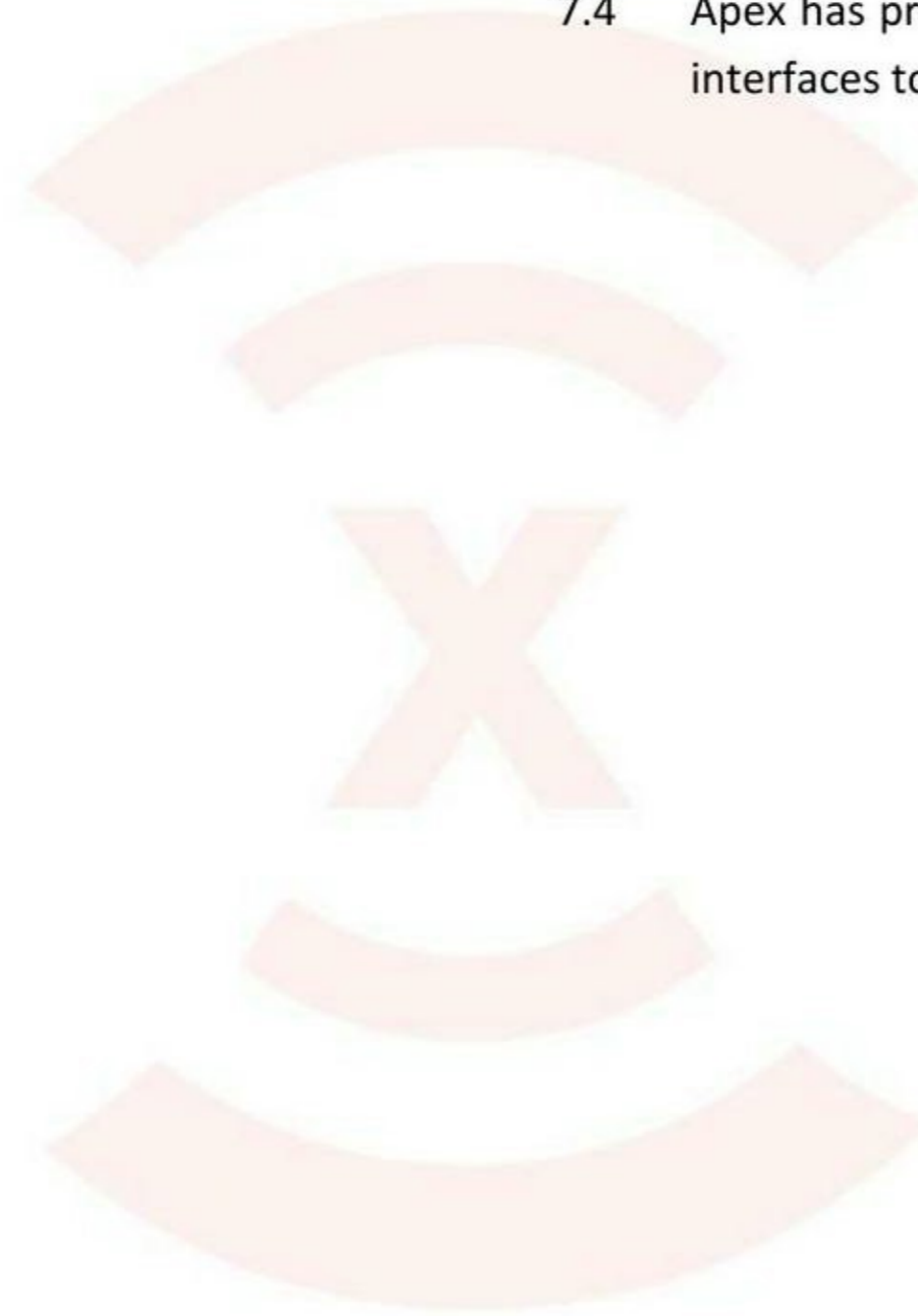
Table 8: Summary of recommended E1 floor specifications		
Requirement	Specification	
Requirement E1 43 dB $D_{nT,w} + C_{tr}$	Level 01 floor Between retail and residential	<ul style="list-style-type: none"> Repair and seal all gaps in existing floor boards Overboard the existing ceiling to 20 kg/m², e.g. with 1 x 19 mm Gyproc Plan, or 2 x 12.5 mm WallBoard Additional MF ceiling below to provide minimum 150 mm void between existing ceiling and new ceiling 100mm mineral wool, $\geq 24 \text{ kg/m}^3$ e.g. Isover APR1200 within void 2 x 12.5 mm BG SoundBloc

6.20 Flanking transmission via continuous floor / ceiling lining

- 6.21 Plasterboard ceiling linings should not be continuous over any E1 partition.
- 6.22 Where a concrete slab is continuous under a separating partition, to control flanking noise transmissions the slab requires a mass per unit area $\geq 350 \text{ kg/m}^2$. Where this is not achieved, a screed or floating floor treatment may be required on both sides of the separating partition. Any floating floor should not be continuous under the separating partition.
- 6.23 Details of the existing construction are required to provide guidance on specific designs.

7 Conclusion

- 7.1 Based on test data and calculations, appropriate construction options have been identified that are capable of achieving the minimum requirements agreed with the LPA for internal noise levels and internal sound insulation between the uses.
- 7.2 Required façade sound insulation can be met through use of secondary glazing or new glazing meeting the recommended acoustic performance.
- 7.3 Sound insulation requirements between spaces can be achieved by use of the recommended wall and floor constructions.
- 7.4 Apex has provided additional guidance on how to control flanking noise and detail the element interfaces to meet the identified requirements.



8 References

- 1 National Planning Policy Framework, Department for Communities and Local Government, February 2019.
- 2 Noise Policy Statement for England, Department for Environment, Food and Rural Affairs, March 2010.
- 3 BS 8233: 2014, Guidance on sound insulation and noise reduction for buildings.
- 4 Guidelines for Community Noise, Edited by Birgitta Bergland, Thomas Lindvall, Dietrich H Schwela, World Health Organisation, 1999.
- 5 Approved Document F 2010 Edition, The Building Regulations 2000.
- 6 BS EN 12354-3:2000, Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound.
- 7 BS EN ISO 16283-1:2014 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation.
- 8 Architects Drawings. GDL Architecture. 18 Silver Street, Durham. Proposed sections, 200209-GDL-A1-ZZ-DR-A-2300, P01, 28/08/2020. Proposed level 0 plan, 200209-GDL-A1-00-DR-A-2100, P01, 28/08/2020. Proposed level 1 plan, 200209-GDL-A1-01-DR-A-2100, P03, 26/11/2020. Proposed level 2 plan, 200209-GDL-A1-02-DR-A-2100, P02, 01/12/2020. Proposed elevations, 200209-GDL-A1-ZZ-DR-A-2200, P05, 26/11/2020