No.192d Liverpool Road, Cadishead
Noise Assessment Report

Project: No.192d Liverpool Road, Cadishead, Manchester

Client: Bainbridge Developments Ltd

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Signature	

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1. Introduction

1.1 RS Acoustic Engineering Ltd has been appointed by Bainbridge Developments Ltd to undertake a noise assessment with regard to a material change of use at No.192d Liverpool Road, Cadishead, Manchester, M44.

1.2 The mid-terraced property is currently being used for commercial/retail use. The proposals are to retain the ground floor commercial unit and create a single self-contained dwelling on the first floor of the property.

1.3 A noise assessment has been undertaken taking into consideration the guidance contained within British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and ProPG's *Planning & Noise*.

1.4 The guidance given within Approved Document F *Ventilation* and Approved Document E *Resistance to sound* has also been taken into consideration.

1.5 This assessment is based on the results of an environmental noise survey undertaken by RS Acoustic Engineering Ltd. Continuous sound level monitoring has been previously conducted at No.192f to establish the ambient sound pressure levels during the daytime and night-time period.

1.6 The measured sound level data has been used to determine the acoustic performance requirements for the building envelope construction and to determine whether it will be suitable to naturally ventilate habitable rooms via opening windows alone.

1.7 The dominant and consistent source of noise at the site is road traffic on Liverpool Road.

1.8 An assessment of noise ingress through the building envelope with windows open and closed has been undertaken to determine the resulting sound levels.

1.9 Preliminary guidance has been provided with regard to the separating party floor and party wall.

1.10 The survey and assessment was conducted by Mr Ryan Swales ($BSc_{(Hons)}$, MIOA), Principal Acoustic Consultant and Member of the Institute of Acoustics.

1.11 The results of the noise survey have been presented, along with the assessment criteria and a discussion of the results with respect to the appropriate guidance and targets.

1.12 Recommendations regarding sound insulation, ventilation and noise mitigation are also provided within this report.

2. Assessment Guidance & Acoustic Criteria

British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings

2.1 BS 8233 provides guidance regarding acoustic criteria and noise levels appropriate for various types of space that have different functions.

2.2 Regarding dwellings, appropriate internal ambient sound levels are given for bedrooms, living rooms and dining rooms (habitable rooms). The guidelines take into consideration the effect of internal noise on sleep and the effect of noise on resting, listening and communicating.

2.3 The internal sound level targets presented in Table 2.1 have been reproduced directly from the standard.

Table 2.1 - Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	---
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	---
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

2.4 Note 7 of the standard also suggests that in some circumstances it may be appropriate to relax the indoor ambient noise level targets by up to 5 dB:

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

2.5 Note 5 also states:

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

World Health Organisation: Guidelines for community noise (1999)

2.6 To help avoid sleep disturbance within bedrooms, this historical guidance document recommends that the night-time internal ambient sound level should not exceed 30 dB $L_{Aeq,T}$ and the maximum sound level should not typically exceed 45 dB $L_{AFmax,T}$.

2.7 The corresponding values directly outside of bedroom windows are therefore 45 dB $L_{Aeq,8hour}$ and 60 dB $L_{AFmax,T}$. This assumes that a partially open window provides approximately 15 dB of sound attenuation (from external noise).

2.8 With regard to sleep disturbance and maximum L_{AFmax} sound levels, the study undertaken by Vallet & Vernet (1991) suggests that for good sleep, indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night.

Professional Practice Guidance on Planning & Noise (2017)

2.9 Professional Practice Guidance on Planning and Noise (ProPG) has been produced in order to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

2.10 The NPPF encourages improved standards of design. This guidance document encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

2.11 The scope of ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transportation sources.

Internal noise level guidelines

2.12 The recommended ProPG internal noise level guidelines are presented in Table 2.2. The guidelines reflect and extend current practice contained within BS 8233:2014.

Table 2.2 - ProPG internal noise level guidelines

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	---
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	---
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$ 45 dB $L_{Amax,F}$

2.13 Where the local planning authority accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment.

2.14 In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "*whole dwelling ventilation*" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position.

2.15 It should also be noted that the internal noise level guidelines are generally not applicable under "*purge ventilation*" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

Building Regulations 2010 - Approved Document E

2.16 The Building Regulations 2010, Approved Document E *Resistance to the passage of sound*, provides minimum sound insulation standards for separating wall and floor constructions between adjacent dwellings (houses, flats and rooms for residential purposes).

2.17 The current acoustic performance standards for new-build dwellings and those that have been formed by a material change of use are presented in Table 2.3.

Table 2.3 - Performance standards of Approved Document E

Dwelling-house and flats - performance standards for separating walls, separating floors, and stairs that have a separating function		
	Airborne sound insulation $D_{nT,w}+C_{tr}$ 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

2.18 In this instance, the separating party floor and party wall needs to achieve a minimum airborne performance of 43 dB $D_{nT,w}+C_{tr}$.

2.19 There is no minimum impact sound insulation performance standard where the ground floor receptor is a commercial unit.

3. Environmental Noise Survey

Survey methodology

3.1 An environmental noise survey has been previously conducted by RS Acoustic Engineering Ltd.

3.2 Continuous sound level monitoring was conducted over a 48-hour period on the front elevation of the neighbouring property facing Liverpool Road (No.192f). The equipment was installed at first floor level (position A).

3.3 Measurements were performed from 11:30 hours on Wednesday 29th through to 11:30 hours on Friday 31st January 2025.

3.4 Sample measurements were also conducted over several hours on the rear elevation. The equipment was installed at first floor level (position B) and was time-synchronised with the sound level meter on the front elevation.

3.5 A measurement interval of 2-minutes was used during the survey and measurements were subject to sound reflections from the façade (as opposed to free-field). One-third octave band and A-weighted broadband sound pressure levels were recorded during the survey.

3.6 The site location, surrounding area and survey measurement positions are shown in Figure 3.1 and Figure 3.2 overleaf. The floor plans and elevations are presented in Appendix A.

Figure 3.1 - Site location and survey measurement positions (source: Google Earth)

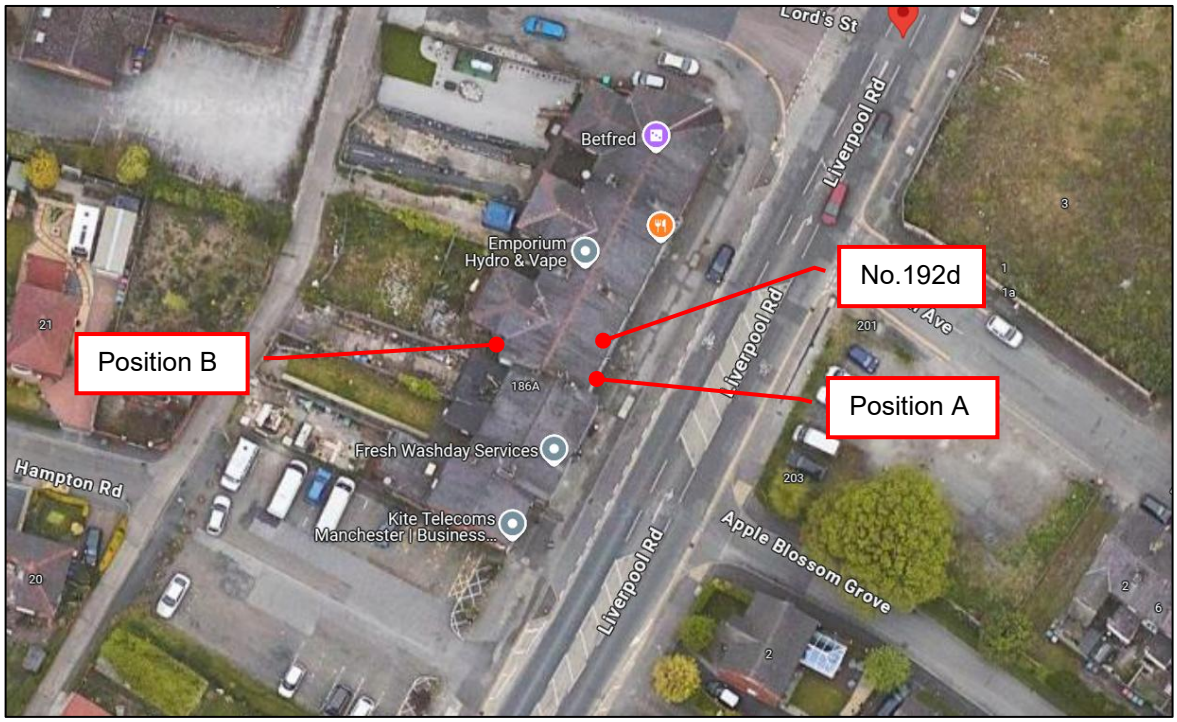


Figure 3.2 - Photographs showing survey measurement positions

Survey equipment

3.7 The survey was conducted using the following Class-1 specification equipment:

- Brüel & Kjaer 2250-Light sound level meter, microphone type 4189, pre-amplifier type ZC0032.
- Brüel & Kjaer 2260 sound level meter, microphone type 4189, pre-amplifier type ZC0032.
- CEL-120/1 Acoustic calibrator.

3.8 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories (calibration certificates are available upon request).

3.9 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the measurements performed. Calibration drift was less than 0.1 dB.

Weather conditions

3.10 The weather conditions during the survey were generally dry and fine with a light cloud cover. Wind speed measurements taken outside of the building were between 0.2 and 1.7 m/s^{-1}.

3.11 The air temperature during the survey ranged between 1°C and 7°C. The overall weather conditions were considered suitable to obtain representative measurements.

Subjective observations of the acoustic environment

3.12 The dominant and consistent source of noise is road traffic on Liverpool Road.

3.13 Vehicle movements along Lord's Street, Hampton Road, Lytherton Avenue and Apple Blossom Grove also contribute to the measured noise levels at the site, but too a much lesser degree than Liverpool Road.

3.14 During the daytime and night-time site visits, there was no audible building services plant noise associated with the neighbouring properties.

3.15 Operational noise associated with the neighbouring commercial premises was generally negligible during the site visits and mainly consisted of vehicles parking along Liverpool Road or within the small neighbouring carpark.

3.16 Other noted sources of noise include passing pedestrians, domestic activity at neighbouring dwellings and high-altitude aircraft.

Results summary

Measured noise indices

3.17 Although a wide range of statistical sound level data was recorded during the survey, the L_{Aeq} and L_{AFmax} indices are of most interest in this instance:

- $L_{Aeq,T}$ - The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period and commonly used to describe the 'ambient' sound level.
- $L_{AFmax,T}$ - The A-weighted 'maximum' sound pressure level that occurred during a given period, T. Commonly used for the assessment of occasional and transient loud noises.

3.18 Sound pressure level measurements are taken with an A-weighting (denoted by a subscript 'A', e.g. L_{Aeq}) to approximate the frequency response of the human ear.

Measurements on front elevation

3.19 Table 3.1 presents a summary of the continuously measured sound pressure levels on the front elevation. Measured values have been rounded to the nearest whole number.

Table 3.1 - Summary of continuously measured sound pressure levels, front elevation

Date	Period	Duration, T (hours)	$L_{Aeq,T}$ dB	10th Highest[1] $L_{AFmax,T}$ dB	15th Highest[2] $L_{AFmax,T}$ dB
Wednesday 29/01/2025	Daytime (11:30-23:00)	11.5	69	---	---
	Night-time (23:00-07:00)	8	63	82	81
Thursday 30/01/2025	Daytime (07:00-23:00)	16	69	---	---
	Night-time (23:00-07:00)	8	63	82	80
Friday 31/01/2025	Daytime (07:00-11:30)	4.5	71	---	---

[1]The 10th highest measured value. [2]The 15th highest measured value (note: indoor sound pressure levels should ideally not exceed 45 dB L_{Amax} more than 10-15 times per night). --- Daytime values are not presented since there is no L_{AFmax} target for the daytime.

3.20 The daytime ambient sound pressure level was 69 dB $L_{Aeq,16hour}$ and the night-time ambient sound pressure level was 63 dB $L_{Aeq,8hour}$.

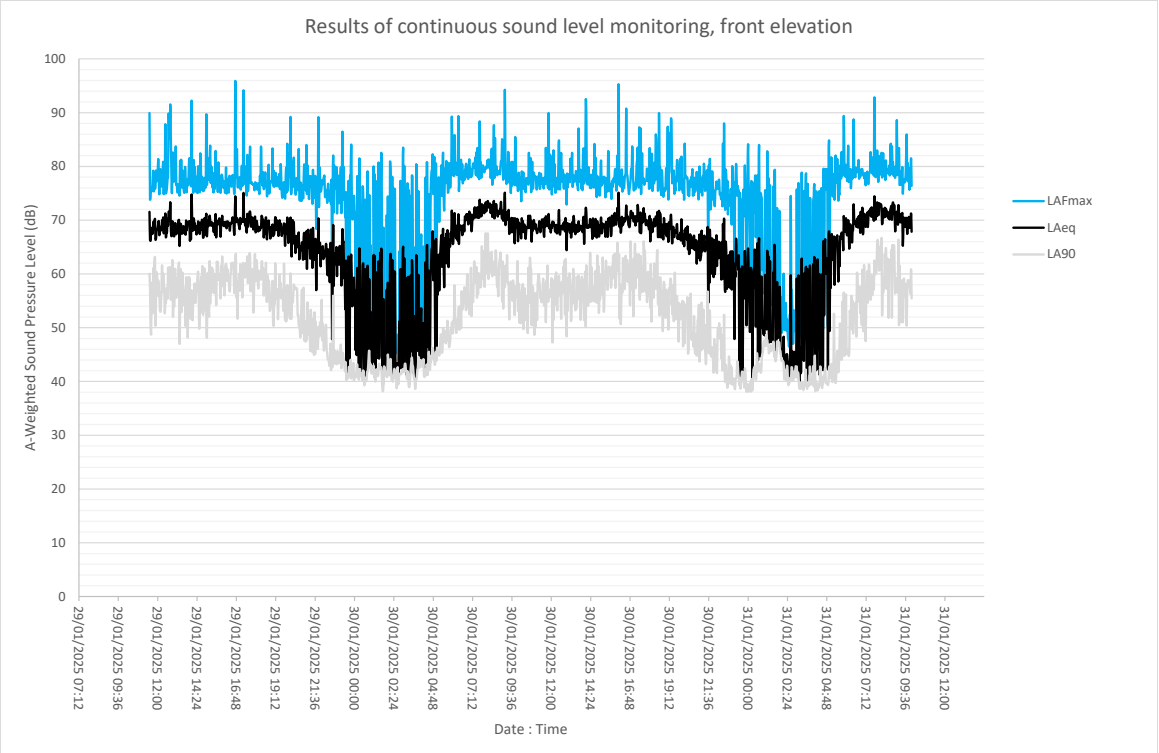
3.21 The measured sound pressure levels are presented graphically in Figure 3.3 overleaf. Additional tabulated survey data can be made available upon request.

Measurements on rear elevation

3.22 The results of the measurements conducted on the rear elevation indicate daytime ambient sound pressure levels ranging between 43 to 47 dB $L_{Aeq,T}$.

3.23 The measured sound pressures levels were approximately 20 to 23 dB L_{Aeq} lower on the rear elevation when compared to the measurements obtained simultaneously on the front elevation. The difference in sound level is due to the rear elevation being acoustically screened from Liverpool Road.

Figure 3.3 - Graph showing results of continuous sound level monitoring, front elevation of No.192f



4. Assessment & Discussion

Building envelope construction and acoustic performance

4.1 The external walls are of a traditional double-leaf brickwork construction. The sound insulation performance is expected to be approximately 50 to 60 dB R_w.

4.2 The roof and ceiling construction consists of a pitched tiled roof, mineral wool (loft) insulation and plasterboard ceiling. The roof and ceiling combination is expected to provide a sound insulation performance of approximately 40 to 50 dB R_w.

4.3 The windows to the front and rear elevations are currently single glazing approximately 3 to 4 mm thick set within timber frames. The frames are in a state of disrepair and need replacing.

4.4 The sound insulation performance of the existing single glazing is estimated to be approximately 24 to 25 dB R_w.

4.5 Purge ventilation is provided by natural means (opening windows) and there are currently no wall or frame mounted ventilator units to the front or rear elevations.

Noise ingress with windows closed

Bedrooms on front elevation

4.6 Table 4.1 and Table 4.2 present the noise ingress calculation results for the first-floor bedrooms on the front elevation.

4.7 The calculations consider the sound insulation performance of each building element, surface area and internal room dimensions.

4.8 Standard thermal double glazing consisting of 4 mm glass / 16 – 20 mm cavity / 4 mm glass has been initially assumed in the calculations.

4.9 The daytime sound pressure level measured on the front elevation has been used in the calculations (69 dB $L_{Aeq,16hour}$). The measured octave-band sound levels and typical reverberation time for a habitable room have also been taken into consideration.

Table 4.1 - Noise ingress calculation 192d: bedroom 1 with standard thermal glazing

Plot 192d- 1st Floor Bedroom 1 **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				24.5	23.1	30.8	39.6	42.2	37.2			
L_{in}				42.5	41.9	33.2	27.4	17.8	11.8			
Materials												
4mm glass/18mm cavity/4mm glass		2.7		21.0	17.0	25.0	35.0	37.0	31.0		**29**	**(-1,-4)**
Double-leaf brickwork wall		5.3		40.0	44.0	45.0	51.0	56.0	60.0		**51**	**(-1,-4)**
Tiled roof, insulation, plasterboard ceiling		12.8		28.0	34.0	40.0	45.0	49.0	50.0		**44**	**(-2,-5)**
$L_{out,s}$												
$L_{out,2m}$	Add Element			67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{out,free\ field}$				64.0	62.0	61.0	64.0	57.0	46.0		**66**	
Element 1				24.5	23.1	30.8	39.6	42.2	37.2			
Plane façade	ΔL_{fs}	20.8		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	x_{fs}	0.0		24.5	23.1	30.8	39.6	42.2	37.2			
$L_{p,out,2m}$				67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{p,in}$				42.5	41.9	33.2	27.4	17.8	11.8		**36**	**dBA**

Table 4.2 - Noise ingress calculation 192d: bedroom 2 with standard thermal glazing

Plot 192d- 1st Floor Bedroom 2 **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				24.3	22.6	30.4	39.3	41.9	36.8			
L_{in}				42.7	42.4	33.6	27.7	18.1	12.2			
Materials												
4mm glass/18mm cavity/4mm glass		1.8		21.0	17.0	25.0	35.0	37.0	31.0		**29**	**(-1,-4)**
Double-leaf brickwork wall		4.4		40.0	44.0	45.0	51.0	56.0	60.0		**51**	**(-1,-4)**
Tiled roof, insulation, plasterboard ceiling		7.7		28.0	34.0	40.0	45.0	49.0	50.0		**44**	**(-2,-5)**
$L_{out,s}$												
$L_{out,2m}$	Add Element			67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{out,free\ field}$				64.0	62.0	61.0	64.0	57.0	46.0		**66**	
Element 1				24.3	22.6	30.4	39.3	41.9	36.8			
Plane façade	ΔL_{fs}	13.9		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	x_{fs}	0.0		24.3	22.6	30.4	39.3	41.9	36.8			
$L_{p,out,2m}$				67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{p,in}$				42.7	42.4	33.6	27.7	18.1	12.2		**37**	**dBA**

4.10 The calculation results indicate a daytime internal sound level of approximately 36 to 37 dB $L_{Aeq,16hour}$ with standard thermal double glazing.

4.11 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore not be achieved.

4.12 Since the daytime sound level target will not be achieved, it is recommended that the glazing to the front elevation is acoustically enhanced.

Acoustically laminated double glazing to bedrooms

4.13 A suitable noise mitigation measure would be to replace the existing glazing with acoustically laminated double glazing.

4.14 Table 4.3 and Table 4.4 present the calculation results with acoustically laminated double glazing installed on the front elevation (e.g. 6 mm clear glass / 16 – 20 mm cavity / 6.8 mm acoustically laminated glass).

4.15 An alternative glazing configuration can be installed so long as the unit achieves a similar acoustic performance (i.e. 37 dB R_w).

Table 4.3 - Noise ingress calculation 192d: bedroom 1 with acoustically laminated glazing

Plot 192d- 1st Floor Bedroom 1 **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				25.4	28.7	36.8	42.9	45.9	49.0			
L_{in}				41.6	36.3	27.2	24.1	14.1	0.0			
Materials												
6mm glass/16-20mm cavity/6.8mm acou lam		2.7		23.0	24.0	34.0	42.0	43.0	52.0		**37**	**(-2,-6)**
Double-leaf brickwork wall		5.3		40.0	44.0	45.0	51.0	56.0	60.0		**51**	**(-1,-4)**
Tiled roof, insulation, plasterboard ceiling		12.8		28.0	34.0	40.0	45.0	49.0	50.0		**44**	**(-2,-5)**
$L_{out,s}$												
$L_{out,2m}$	Add Element			67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{out,free\ field}$				64.0	62.0	61.0	64.0	57.0	46.0		**66**	
Element 1				25.4	28.7	36.8	42.9	45.9	49.0			
Plane façade	ΔL_{fs}	20.8		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	x_{fs}	0.0		25.4	28.7	36.8	42.9	45.9	49.0			
$L_{p,out,2m}$				67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{p,in}$				41.6	36.3	27.2	24.1	14.1	0.0		**32**	**dBA**

Table 4.4 - Noise ingress calculation 192d: bedroom 2 with acoustically laminated glazing

Plot 192d- 1st Floor Bedroom 2 **Noise Break In (ISO 12354-3)**											
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				25.2	28.4	36.5	42.6	45.6	48.9			
L_{in}				41.8	36.6	27.5	24.4	14.4	0.1			
Materials												
6mm glass/16-20mm cavity/6.8mm acou lam		1.8		23.0	24.0	34.0	42.0	43.0	52.0		**37**	**(-2,-6)**
Double-leaf brickwork wall		4.4		40.0	44.0	45.0	51.0	56.0	60.0		**51**	**(-1,-4)**
Tiled roof, insulation, plasterboard ceiling		7.7		28.0	34.0	40.0	45.0	49.0	50.0		**44**	**(-2,-5)**
$L_{out,s}$												
$L_{out,2m}$	Add Element			67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{out,free\ field}$				64.0	62.0	61.0	64.0	57.0	46.0		**66**	
Element 1				25.2	28.4	36.5	42.6	45.6	48.9			
Plane façade	ΔL_{fs}	13.9		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	x_{fs}	0.0		25.2	28.4	36.5	42.6	45.6	48.9			
$L_{p,out,2m}$				67.0	65.0	64.0	67.0	60.0	49.0		**69**	
$L_{p,in}$				41.8	36.6	27.5	24.4	14.4	0.1		**32**	**dBA**

4.16 The calculation results indicate a daytime internal sound level of approximately 32 dB $L_{Aeq,16hour}$ with acoustically laminated double glazing installed.

4.17 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore be achieved.

4.18 Since the night-time L_{Aeq} sound level is approximately 6 dB lower than the daytime sound level, the night-time sound level target of 30 dB $L_{Aeq,8hour}$ will also be achieved.

4.19 The recommended 'maximum' sound level target of 45 dB L_{AFmax} will also be achieved within bedrooms during the night-time period.

- 82 dB $L_{AFmax,2min}$ – 37 dB R_w+C_{tr} = 45 dB $L_{AFmax,2min}$

4.20 As an example, Pilkington Optiphon or Stadip Silence is a high performing acoustic laminate that is used within residential double-glazing:

- www.pilkington.com/en-gb/uk/products/product-categories/noise-control/pilkington-optiphon/
- SGG STADIP SILENCE® | Saint-Gobain Building Glass (saint-gobain-building-glass.com)

Lounge/kitchen on rear elevation

4.21 Daytime façade sound pressure levels are approximately 43 to 47 dB $L_{Aeq,16hour}$ and are approximately 20 to 23 dB lower on the rear elevation when compared to the front elevation.

4.22 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore be easily achieved with standard thermal double glazing.

4.23 A suitable glazing configuration would be 4 mm glass /16 - 20 mm cavity /4 mm glass or alternatively 6 mm glass /16 - 20 mm cavity /6 mm glass.

4.24 The night-time sound level target of 30 dB $L_{Aeq,8hour}$ applies to bedrooms and does not apply to lounges/living rooms, kitchens and dining rooms. However, it is worth noting that the night-time sound level target of 30 dB $L_{Aeq,16hour}$ will be easily achieved within the lounge/kitchen with standard double glazing.

Noise ingress with windows open

4.25 The level of sound attenuation through an open window is dependent on the type and size of window, the extent of opening, the angle of sound incidence and the characteristics of the noise source in question.

4.26 It is reasonable to assume a sound attenuation performance of approximately 15 dB for a partially open window. Partially open windows will provide background ventilation only, as opposed to rapid/purge ventilation.

4.27 BS 8233 provides the following guidance regarding the sound insulation from an open window:

If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB[3]. [3)] Note that the level difference through a window partially open for ventilation can vary significantly depending on the window type and the frequency content of the external noise. If the specific details of the window and external noise are known the value for insulation may be adjusted accordingly.

Bedrooms on front elevation

4.28 Daytime façade sound pressure levels are approximately 69 dB $L_{Aeq,16hour}$ and night-time sound pressure levels are approximately 63 dB $L_{Aeq,8hour}$.

4.29 When assessing noise ingress through an open window, it is appropriate to correct the measured sound levels at the façade by approximately -3 dB to give an equivalent free-field sound level.

4.30 The corresponding free-field sound pressure levels are therefore 66 dB $L_{Aeq,16hour}$ during the daytime and 60 dB $L_{Aeq,8hour}$ during the night-time.

4.31 Assuming a partially open window provides 15 dB of sound attenuation, the resulting internal sound level is approximately 51 dB $L_{Aeq,16hour}$ during the daytime and approximately 45 dB $L_{Aeq,8hour}$ during the night-time.

Daytime

- 66 dB $L_{Aeq,16hour}$ – 15 dB = 51 dB $L_{Aeq,16hour}$

Night-time

- 60 dB $L_{Aeq,8hour}$ – 15 dB = 45 dB $L_{Aeq,8hour}$

4.32 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will not be achieved with windows open.

4.33 The night-time sound level target of 30 dB $L_{Aeq,8hour}$ will also not be achieved with windows open.

4.34 Since the internal sound level targets will not be achieved with windows open, it is recommended that an 'alternative' method of ventilation is provided to the bedrooms, such as acoustic ventilator units to window frames/walls.

Alternative ventilation to bedrooms

4.35 BS 8233 states where occupants rely on closed windows to meet the internal noise limits, there needs to be appropriate *alternative ventilation* that does not compromise the facade sound insulation or resulting internal sound level.

4.36 BS 8233 also provides the following comment with regard to ventilation:

The Building Regulations' supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

4.37 Based on the guidance above, it is recommended that an alternative means of ventilation is provided for the bedrooms on the front elevation (i.e. in addition to opening windows).

4.38 Taking into consideration the measured sound levels, a suitable noise mitigation measure would be to install good quality acoustic (sound attenuating) ventilator units to the front elevation.

4.39 Installing a background ventilator directly through a wall that provides the equivalent areas described in Approved Document F can also be an acceptable route to compliance (as opposed to installing the ventilator unit within the window frame).

4.40 It is anticipated that installing a ventilator unit will be the simplest and most cost-effective noise mitigation measure (compared to installing mechanical ventilation).

4.41 Further guidance regarding ventilator types and acoustic performance is provided below.

4.42 It will however be appropriate to provide rapid or purge ventilation by fully opening the window (e.g. to remove odour from painting and decorating or from burnt food).

Lounge/kitchen on rear elevation

4.43 Free-field sound pressure levels are approximately 40 to 44 dB $L_{Aeq,16hour}$ during the daytime period.

4.44 Assuming a partially open window provides 15 dB of sound attenuation, the resulting internal sound level is approximately 25 to 29 dB $L_{Aeq,16hour}$ during the daytime.

Daytime

- 44 dB $L_{Aeq,16hour}$ – 15 dB = 29 dB $L_{Aeq,16hour}$

4.45 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore be easily achieved with windows open.

4.46 Since the recommended sound level target will be achieved with windows open, an alternative method of ventilation such as acoustic ventilator units or mechanically assisted ventilation is unnecessary for the lounge/kitchen.

4.47 Where required to satisfy Part F of the Building Regulations, a standard (non-acoustic) trickle vent may be installed within the frame of the new window.

Ventilation and noise mitigation options

Acoustically rated ventilator units

4.48 Manually controlled trickle ventilators are the most common type of background ventilator and can be located over the window frames, in the frames, just above the glass or directly through the wall.

4.49 Sound attenuating (acoustically rated) ventilator units can be installed to habitable rooms (bedrooms) to allow background ventilation whilst maintaining a high acoustic performance from the façade.

4.50 The new ventilator unit to the front elevation should provide a sound insulation performance of at least **40 dB $D_{n,e,w}$** in the open position.

4.51 For guidance, example manufacturers of sound attenuating ventilator units include:

- EHA² | Aereco
- 2500EA/5000EA AC1 (greenwood.co.uk)
- https://brookvent.co.uk/product/airvent-sm-acoustic-window-vent-surface-mounted-brookvent/
- https://brookvent.co.uk/wall-vents/

4.52 The minimum ‘equivalent area’ of background ventilators for natural ventilation should follow the guidance in Table 1.7 of Approved Document F for each room type.

4.53 It should be noted that a window with a 'night-latch' position is not adequate for background ventilation, due to the risk of draughts, security issues and the difficulty of measuring the equivalent area.

Single room heat recovery ventilation unit

4.54 Heat recovery units are designed to improve indoor air quality and lower the risk of condensation. Single room heat recovery units tend to be more efficient than traditional extract ventilation systems but are not as complex to install as the centralised packaged units for the whole building.

4.55 Example through-the-wall systems include:

- https://www.vent-axia.com/range/lo-carbon-heat-save

Mechanically assisted ventilation

4.56 A further option regarding ventilating and cooling habitable rooms whilst achieving a high facade sound insulation would be to use a mechanical ventilation system, such as a heat recovery system (MVHR) or positive input ventilation system (PIV).

4.57 Example suppliers of MVHR and PIV systems include:

- www.nuaire.co.uk/residential/positive-input-ventilation
- www.envirovent.com/specifier/products/heat-recovery-systems/

4.58 With a loft mounted motor and control unit, particular attention should be paid to the construction of bedroom ceilings and the mounting of the motor unit in order to minimise the noise transmission into adjacent rooms. It is commonplace for a double-boarded ceiling construction and acoustically enhanced loft-hatch to be used where there is a loft mounted motor/control unit.

Ambient sound level in outdoor living areas

4.59 With regard to outdoor living areas (gardens), BS 8233 provides the following guidelines:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

4.60 ProPG also states the following with regard to noise levels:

The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$.

4.61 The façade sound pressure level to the rear of the property is approximately 43 to 47 dB $L_{Aeq,16hour}$ during the daytime period. The equivalent free-field sound pressure level is 40 to 44 dB $L_{Aeq,16hour}$ (e.g. when stood away from the rear elevation).

4.62 The daytime ambient sound pressure level within the rear garden is therefore expected to achieve and even improve on the guideline value of 50 to 55 dB $L_{Aeq,16hour}$ which is considered appropriate for residential amenity space. Specific noise mitigation measures for the rear garden are therefore unnecessary.

Internal sound insulation and acoustic separation

Separating party floor

4.63 The separating floor construction appears to consist of timber floorboards, 175 mm timber joists (no insulation between joists) and a lath/plaster ceiling.

4.64 The typical airborne sound insulation performance of such a construction is approximately 36 to 41 dB $D_{nT,w}+C_{tr}$.

4.65 The airborne sound insulation performance of the existing floor is therefore expected to be below the minimum performance standards of Approved Document E.

4.66 It is assumed that acoustic enhancement to the upper side of the floor (such as a cradle-and-batten system) will be impractical due to creating issues with floor heights, staircase step-heights and door frame heights etc.

4.67 The following recommendations are therefore based on improvements to the underside of the floor.

Metal-frame suspended plasterboard ceiling

4.68 A suspended ceiling could be installed to the underside of the separating floor consisting of 2 x 12.5 mm SoundBloc plasterboard on a metal-frame system.

4.69 Alternatively, 2 x 15 mm FireLine plasterboard may be used or similar dense plasterboards (e.g. Siniat's dB Board/Fire Board.

- Gyproc SoundBloc 12.5mm | Acoustic Plasterboard | British Gypsum (british-gypsum.com)
- https://www.british-gypsum.com/products/board-products/gyproc-fireline-15mm

4.70 Retaining the existing lath/plaster or plasterboard ceilings where possible will provide an additional mass layer within the overall floor build-up, which in turn will help with acoustic performance. Retention of the existing ceilings will also save on the costs associated with the removal and disposal of the existing plaster/wood.

4.71 Where the original ceilings are removed, 150 mm thick Rockwool slabs should be friction-fitted between the joists (which will be accessible with the ceilings removed).

4.72 The new dense plasterboard should be installed with staggered joints. The joints to the outer board layer should be sealed with tape or caulked with sealant and the perimeter edge of the ceiling boards should also be sealed with flexible sealant. Ideally, a small perimeter gap (2 to 3 mm) should be maintained to ensure the new ceiling boards do not touch the surrounding walls.

4.73 The suspension depth between the bottom of the joist and the upper side of the new plasterboard should be at least 150 mm.

4.74 It is also recommended that 100 mm thick mineral wool insulation is installed within the cavity (e.g. Knauf's acoustic partition roll or Isover's APR1200).

- Acoustic Roll Insulation | Glass Mineral Wool (knaufinsulation.co.uk)

4.75 Acoustic hangars should be used to help isolate the metal frame and plasterboard from the separating floor structure, which in turn will notably increase acoustic performance.

4.76 Suitable acoustic hangers include British Gypsum's GAH1 and GAH2:

- https://www.british-gypsum.com/products/metal-products/gypframe-gah1-acoustic-hanger#standards

Recessed downlights

4.77 Where recessed down-lighting is required, acoustic/fire-rated units should be installed throughout to help maintain the acoustic performance of the new ceiling.

Anticipated performance on completion

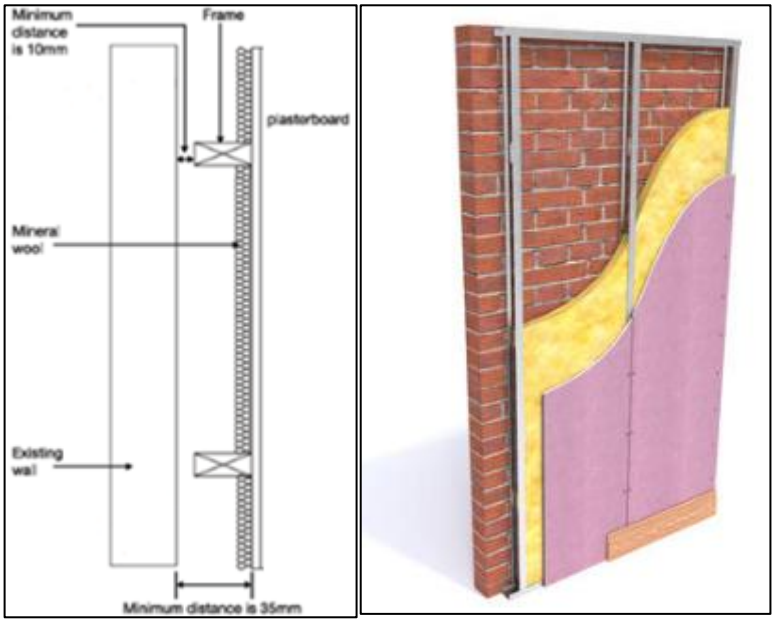
4.78 On completion, the airborne sound insulation performance is expected to be approximately 46 to 49 dB $D_{nT,w}+C_{tr}$ and will therefore be sufficient to achieve the minimum performance standard of Approved Document E.

Separating party wall

4.79 The party wall construction is double-leaf brickwork approximately 285 mm thick.

4.80 The wall should be lined at first floor level with either a fully independent or virtually independent wall lining system. The diagram below shows a fully independent wall lining in which the supporting frame does not touch the masonry wall.

Figure 4.1 - Diagram showing independent wall lining



4.81 The wall lining should ideally consist of 2 x 12.5 mm SoundBloc plasterboard (or 2 x 15 mm FireLine plasterboard) with 50 mm thick mineral wool insulation/slabs fitted between studs.

4.82 The greatest improvement will be achieved via a fully independent wall lining system and it is therefore recommended that an independent lining is used where possible.

- GypLyner Independent Wall Lining System | British Gypsum (british-gypsum.com)

4.83 The supporting framework for the linings can be constructed from metal studs and floor/ceiling channels or alternatively from timber (e.g. 3” x 2” timber battens).

4.84 Where metal is preferred, the independent frame can be constructed from Gypframe floor and ceiling channels with Gypframe ‘I’ studs friction-fitted vertically within the channel sections to form the framework. There should be a gap of at least 10 mm between the metal frame and the existing masonry (to prevent acoustic bridging).

4.85 Where it is impractical to install independent wall linings, a virtually independent wall lining may be used, such as the GypLyner Single metal-framed lining system:

- GypLyner Single Wall Lining System | British Gypsum (british-gypsum.com)

5. Conclusion

5.1 The external walls and roof construction will provide sufficient sound insulation from external noise and do not require acoustic enhancement.

5.2 Acoustic enhancement is required to the glazing on the front elevation so that the daytime and night-time sound level targets can be achieved within the bedrooms. It is recommended that acoustically laminated glazing is installed comprising of 6 mm clear glass / 16 to 20 mm cavity / 6.8 mm acoustic laminate. An alternative glazing configuration can be installed so long as the unit achieves a similar acoustic performance (i.e. 37 dB R_w).

5.3 Standard thermal double glazing will be appropriate for any new units installed on the rear elevation (e.g. 4 mm glass / 16 to 20 mm cavity / 4 mm glass).

5.4 With the window open, the daytime and night-time sound level targets will not be achieved within the bedrooms on the front elevation. An alternative means of ventilation should be provided to the bedrooms such as installing a good quality acoustic ventilator unit within the external wall or window frame.

5.5 The daytime sound level target will be easily achieved with windows open on the rear elevation. Acoustic ventilators are therefore not required for the lounge/kitchen on the rear elevation. Where required to satisfy Part F of the Building Regulations, a standard (non-acoustic) trickle vent may be installed within the frame of the new window.

5.6 The daytime ambient sound pressure level within the rear garden is expected to achieve the guideline value of 50 to 55 dB $L_{Aeq,16hour}$ which is considered appropriate for residential amenity space. Specific noise mitigation measures for the rear garden are therefore unnecessary.

5.7 The separating party floor and party wall will need to be acoustically enhanced to satisfy the performance requirements of Part E of the Building Regulations. Acoustically isolated suspended ceilings can be used to provide a significant improvement in airborne sound insulation performance.

Appendix A
Floor plans and elevations

Figure A.1 - Existing site plan

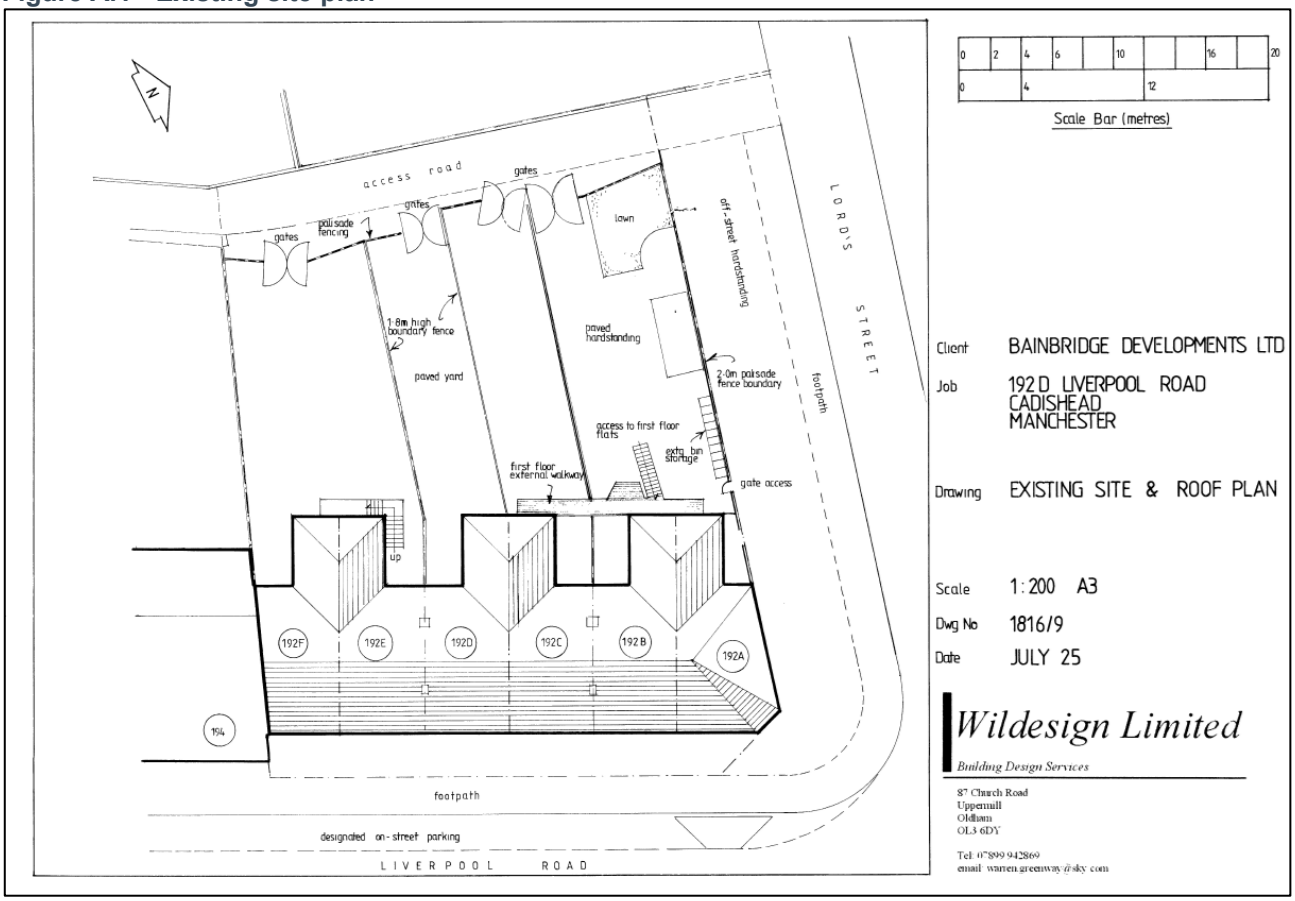


Figure A.2 - Proposed site plan

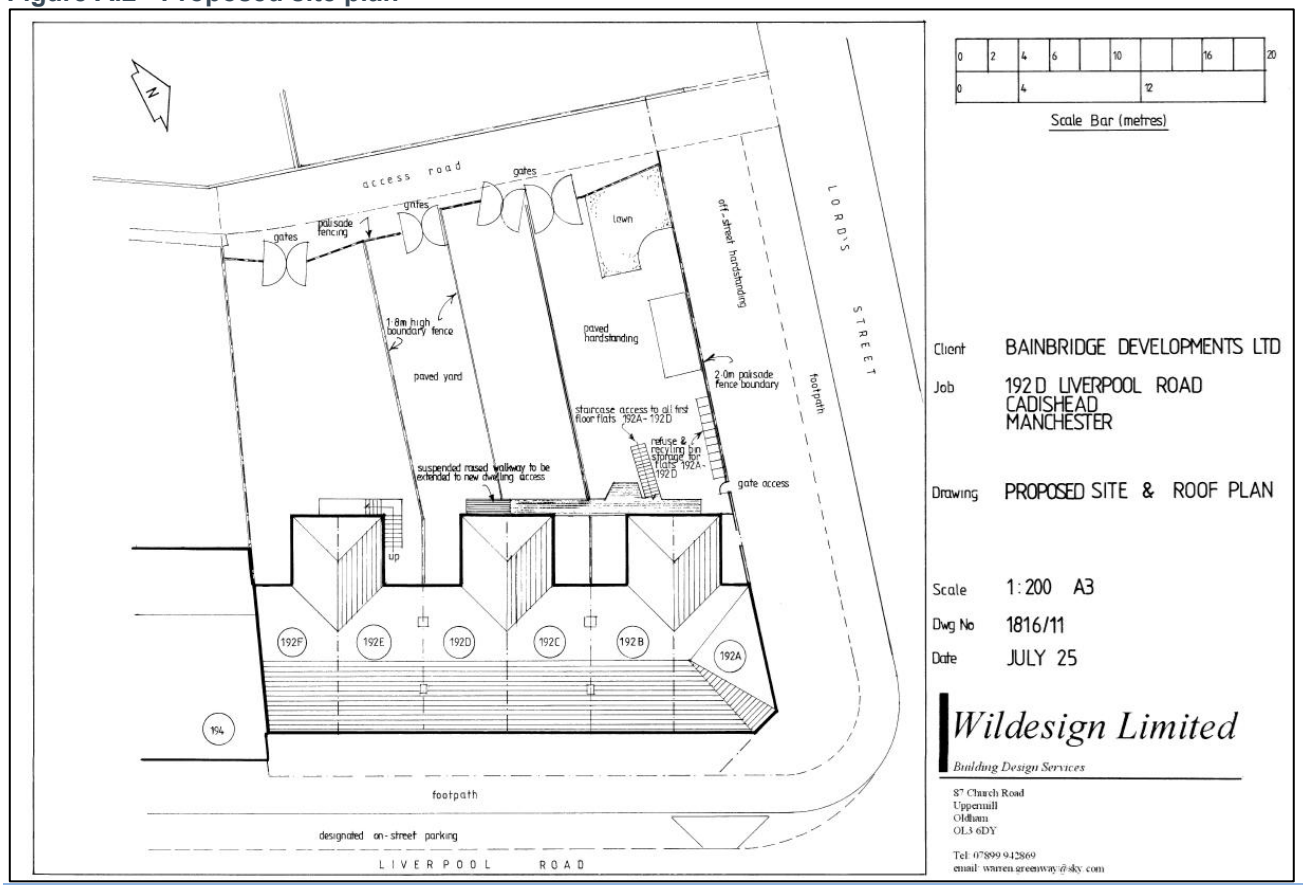


Figure A.3 - Existing floor plans, elevations and section

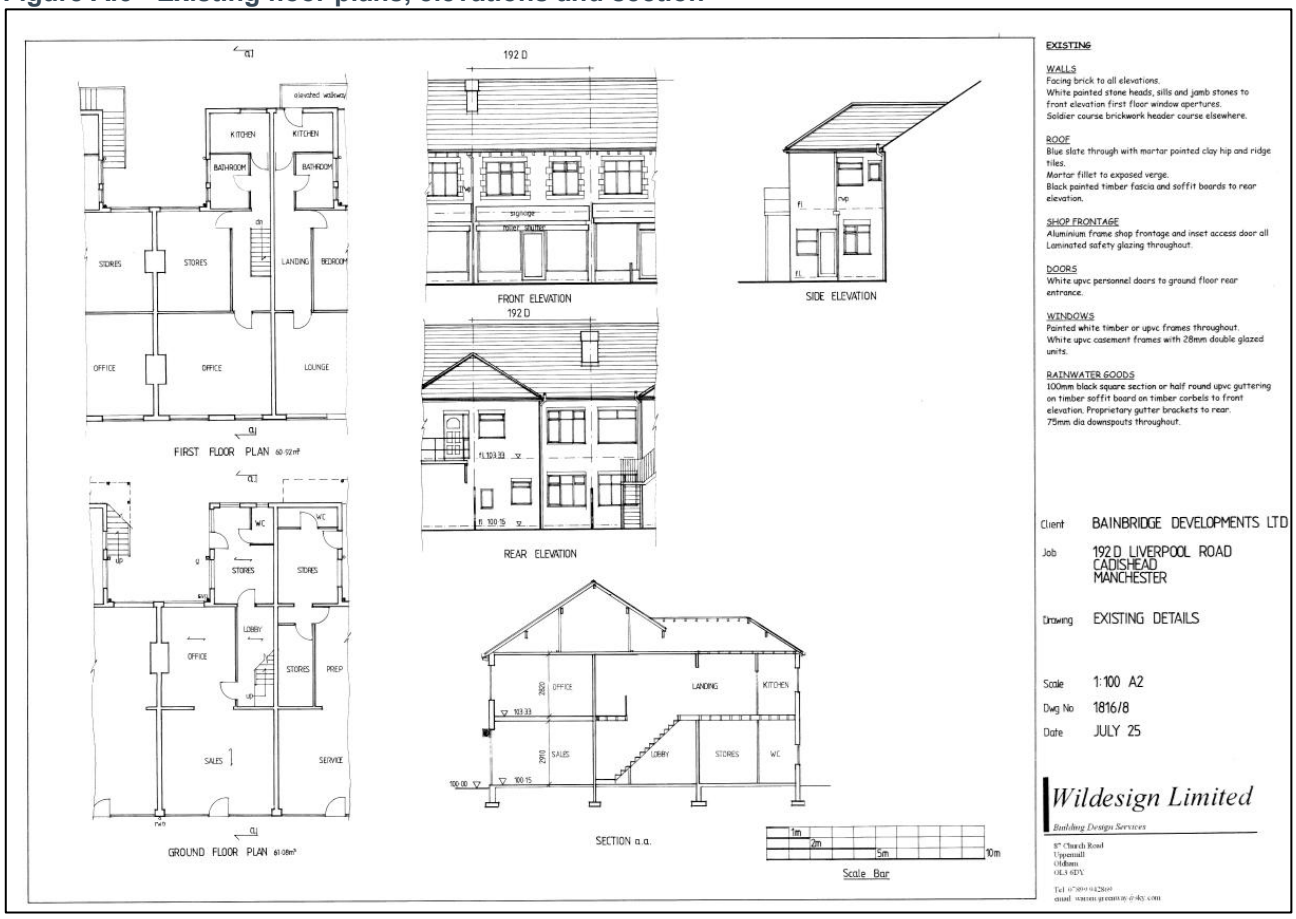
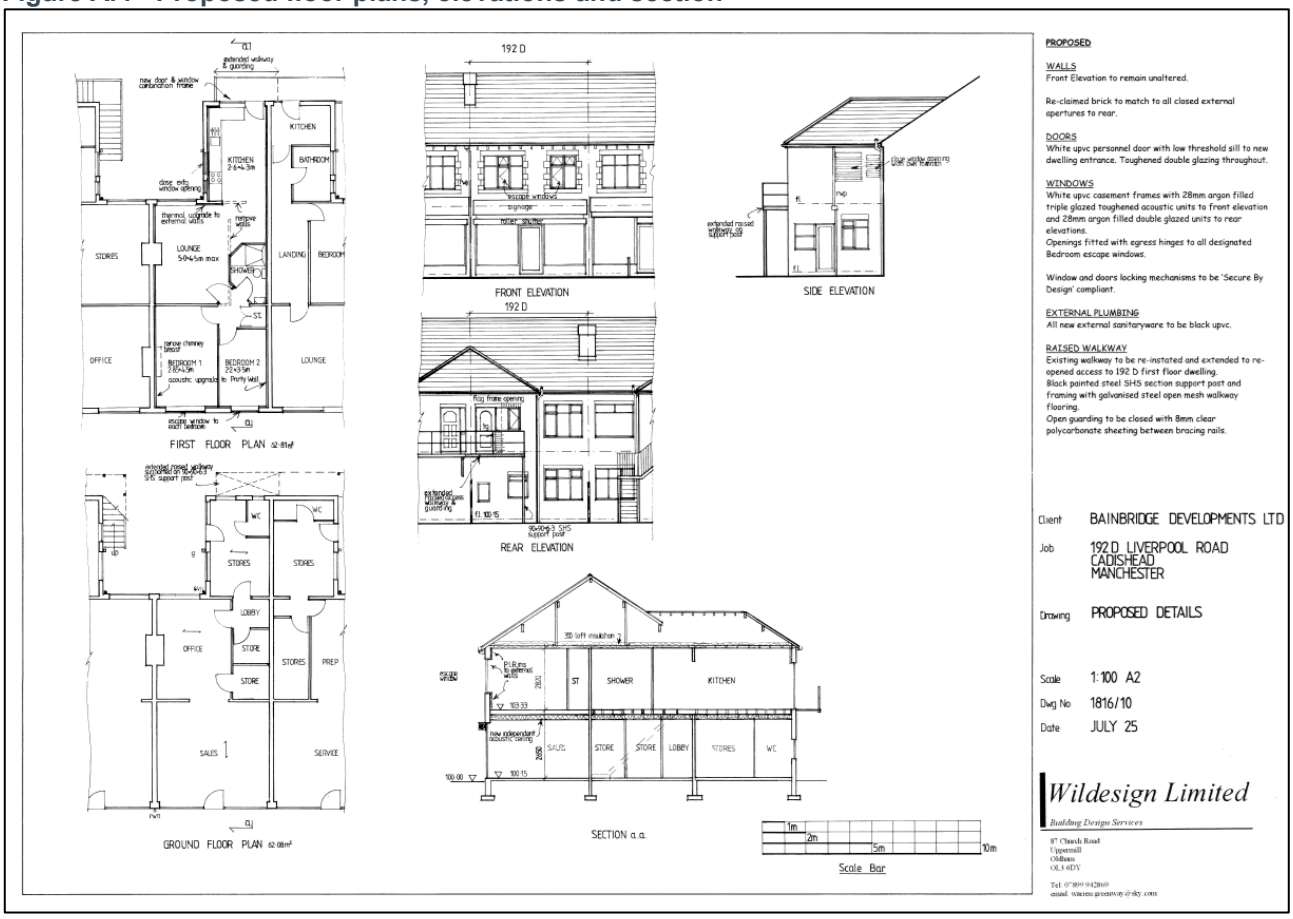


Figure A.4 - Proposed floor plans, elevations and section



Appendix B
Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$Pa).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Equivalent continuous sound level - $L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
Maximum sound level - $L_{AFmax,T}$	The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of intermittent loud noises).
Background sound level - $L_{A90,T}$	The sound pressure level that is exceeded for 90% of the measurement time interval, T. $L_{A90,T}$ is often used to describe the 'background' sound level.
Habitable room	Any room used or intended to be used for sleeping, cooking, living or eating purposes (enclosed spaces such as bath or toilet facilities, service rooms, corridors, laundries, hallways, utility rooms or similar spaces are excluded from this definition).
R_w	The weighted sound reduction index expressed in dB. A single number quantity for airborne sound insulation rating.
Free-field level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other significant reflective surfaces. Generally measured outside and away from buildings (>3.5metres).