

Acoustic Associates Sussex Ltd

Road Traffic Noise Assessment

Site: **163-165 Oxford Road, Reading. RG1 7UZ**
Client: **Perfect Smile Group Holding Limited**

Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics MIOA

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Project: J3112
Issue 1



Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPG24 - Schools Acoustics BB93 -
Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

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DEVON HUMBERSIDE LEICESTERSHIRE NOTTINGHAMSHIRE PETERBOROUGH **SUSSEX** WESSEX WORCESTERSHIRE

Acoustic Associates Sussex Ltd., 8 Highdown House, Shoreham Airport, Shoreham-by-Sea, West Sussex BN43 5PB
Tel: (01273) 455074 Fax: (01273) 455075 e-mail: info@aasussex.co.uk www.aasussex.co.uk

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Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics MIOA

Checked by: Peter Attwood BSc(Hons) MSc MCIOB MIOA

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1 Introduction

Acoustic Associates Sussex Ltd have been appointed to undertake an acoustic assessment to support the planning permission for a partial change of use from a dental surgery to residential flats.

Standards and guidance referenced for this assessment include:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- ProPG Planning Guidance, June 2017
- Building Regulations Approved Document E
- Acoustics Ventilation and Overheating Residential Design Guide January 2020 Version 1.1

External noise levels were measured on site using unattended measurements between 12th to 19th February 2021. Two class 1 sound level meters were used to assess the front façade (Oxford Road) and the rear façade (Goldsmid Road) over a 7-day period. The assessment duration also deliberately included a weekend to ensure that any variation in the soundscape was captured. The building is a Grade II listed building and currently includes a residential apartment at the second floor.

The dominant noise source is that of Oxford Road and the associated road junctions which are traffic light controlled to the North. There is an approximate 19.5dB difference between the front and rear of the application building and good acoustic design has sensitively located the bedroom environments on the rear and quieter facades.

The assessment has considered the requirements of both BS8233:2014 and ProPG2017 on the proposed changes to the building. The assessment has detailed that the living room areas which overlook the noisier façade of Oxford Road require a small uplift in the façade performance and also, residents, whilst being free to open windows of their choosing, will likely require an alternative method of ventilation to reduce noise break in.

The use of secondary glazing and through the wall ventilators has shown that the site is capable of being developed into residential flats without any adverse impact on the future occupants and with BS8233:2014 and ProPG2017 criteria achieved.

The application should not therefore be withheld planning consent on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

A planning application is being made to Reading Borough Council which seeks a partial change of use from underutilised storage areas to residential flats. The property is currently a grade II listed building over 4 storeys with dentistry uses carried out. The application does not propose any new build properties, only conversion of an already existing building.

Presently, at basement level is a living/storage area, with dentistry uses occurring at ground and first floor with ancillary storage/offices at the second floor. It is also relevant to note that the property is currently occupied with a residential flat on the second floor of the Oxford Road façade.

It is proposed to have dentistry uses in the basement/combined with a residential flat, as well as dentistry on the ground floor. The first and second floors will become 4 separate flats accessed from a central stairwell.

This report therefore seeks to assess the external soundscape and make recommendations for the building envelope to ensure that future residents remain protected from road traffic noise.

2.2 Site Location

The site is predominantly impacted by road traffic noise from Oxford Road to the North façade. The front of the property is a T junction (Bedford Road) controlled by traffic lights. Vehicular access to the application site is via an undercroft at Goldsmid Road to the South



Figure 1. Site Location Plan (Orientated North)

2.3 Sound Sources and Soundscape

It is noted that the Oxford Road is the primary and dominant sound source. Bus stops are noted on both sides of Oxford Road in relatively close proximity at 155m to the East and 238m to the West.

The Battle Inn/The Royal public house located approximately 30metres to the immediate North East is noted to have planning permission for demolition and erection of flats and a mixed-use building.

The soundscape to the rear/South is significantly more sheltered. Birdsong, aviation noise, and distant emergency services vehicles could be heard. A compressor from the neighbouring dentists (Markham Associates) was also heard intermittently, although for short periods (under 1 minute) and it is understood only works during the periods when the surgery is in use.

2.4 Proposed Layout

The proposed layout is shown in Figures 2 and 3 below which see the bedrooms as more sensitive spaces located to the quieter rear/Southern façade, which is good acoustic design.

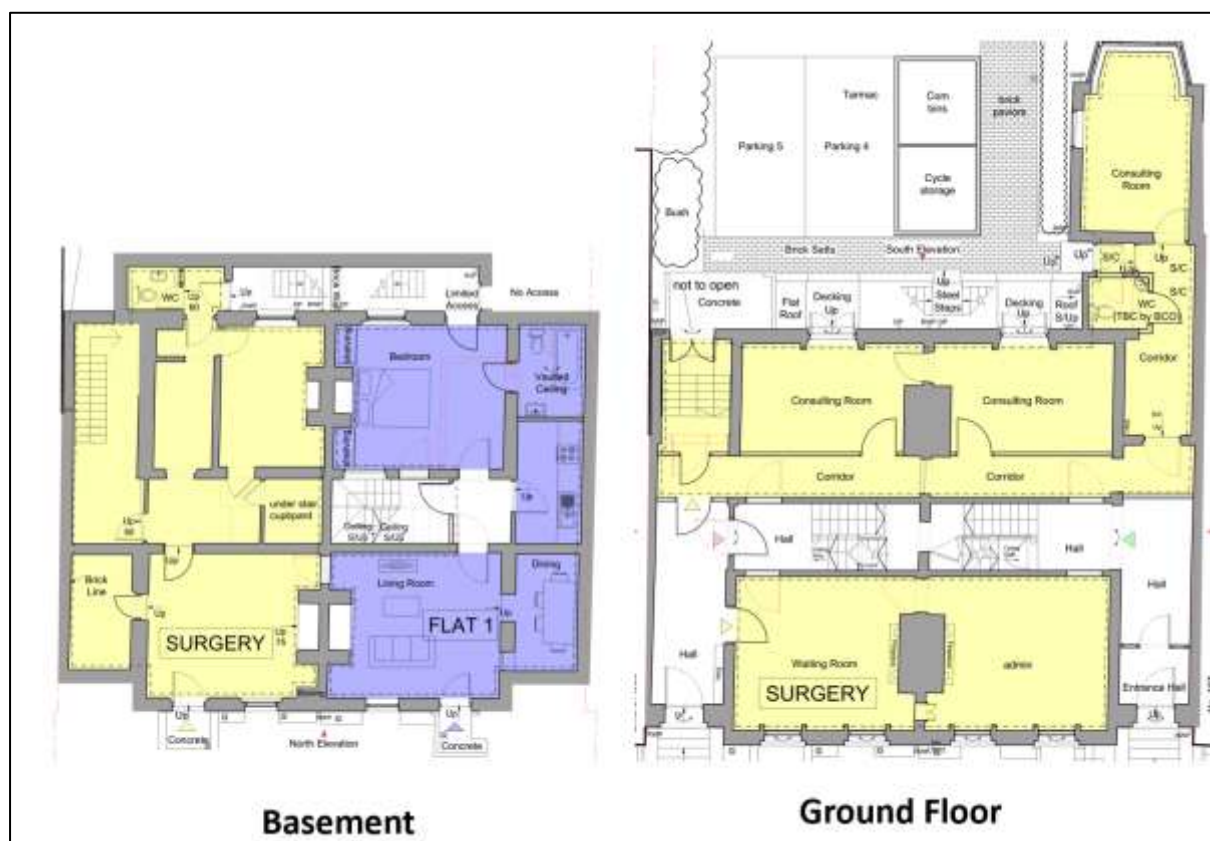


Figure 2. Proposed Basement and Ground Floor Layout



Figure 3. Proposed First and Second Floor Layout

2.5 ProPG Planning Guidance, June 2017

Recent planning guidance (ProPG2017) relates to new residential development and airborne transportation noise, which includes exposure to road traffic, railway and aviation noise. Whilst ProPG, 2017 generally mirrors the requirements of BS8233:2014 and the World Health Organisation Guidelines, 1999, it goes further in setting a limit for inside bedrooms for L_{Amax} events and specifically, no more than 10 L_{Amax} events per night time period above 45dB(A).

The internal bedroom L_{Amax} values will be used in accordance with ProPG2017. An initial site risk assessment will also be produced to detail to decision makers the level of risk associated with the development. The principles of good acoustic design are also referenced throughout.

2.6 BS8233:2014 Noise Criteria

Table 4 of BS8233:2014 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 1. BS8233:2014 Criteria

3 Sound Survey and Assessments

A long-term unattended sound survey was carried out between the 12th February 2021 and 19th February 2021 to assess the ambient sound levels impacting the application site.

Given the proposed site layout with living room areas on the Oxford Road facade and bedrooms located to the rear, two sound level meters were deployed, one on the North façade and one on the South façade. These were measured at second floor level for security purposes and used monopoles protruding from the windows. Given the proximity to the façade, both are considered façade measurements and will be converted to freefield measurements for assessment and consideration hereafter in the report.

The Long- Term surveys will be referred to as LT1 and LT2. A brief simultaneous outside to inside measurement was also undertaken on both North and South elevations to inform the understanding of the façade performance.

3.1 Sound Survey Details

Survey(s) carried out by	Scott Castle BSc(Hons) Env Health, MCIEH CEnvH PGDip Acoustics MIOA
Equipment Used	01dB Black Solo Class 1 Sound Level Meter. Serial No.60673 (Unattended)
Equipment Used	01dB Calibrator (CAL21) – Serial Number 50241778
Location	(LT1) - SU70720/73388 - Pole Mounted at approx. 8m above ground floor level
Duration	12 th February 2021 (09:20) to 19 th February 2021 (09:20)

Table 2. Survey Details (Long Term – LT1)

Survey(s) carried out by	Scott Castle BSc(Hons) Env Health, MCIEH CEnvH PGDip Acoustics MIOA
Equipment Used	Norsonic 118 (C) Class 1 Sound Level Meter –Serial No 31540 (Unattended)
Equipment Used	01dB Calibrator (CAL21) – Serial Number 50241778
Location	(LT2) SU70716/73368 - Pole Mounted at approx. 8m above ground level
Duration	12 th February 2021 09:40 to – 0940 hours 19 th February 2021

Table 3. Survey Details (Long Term - LT2)

The sound level meters (both long term) were calibrated before and after commencing the noise measurements (@94dB with no drift). All measurements were taken with the time base set to 5-minute interval periods.

The unattended sound level meter positions can be seen below in plan in Figure 4 and in photographs in Figure 5 below.

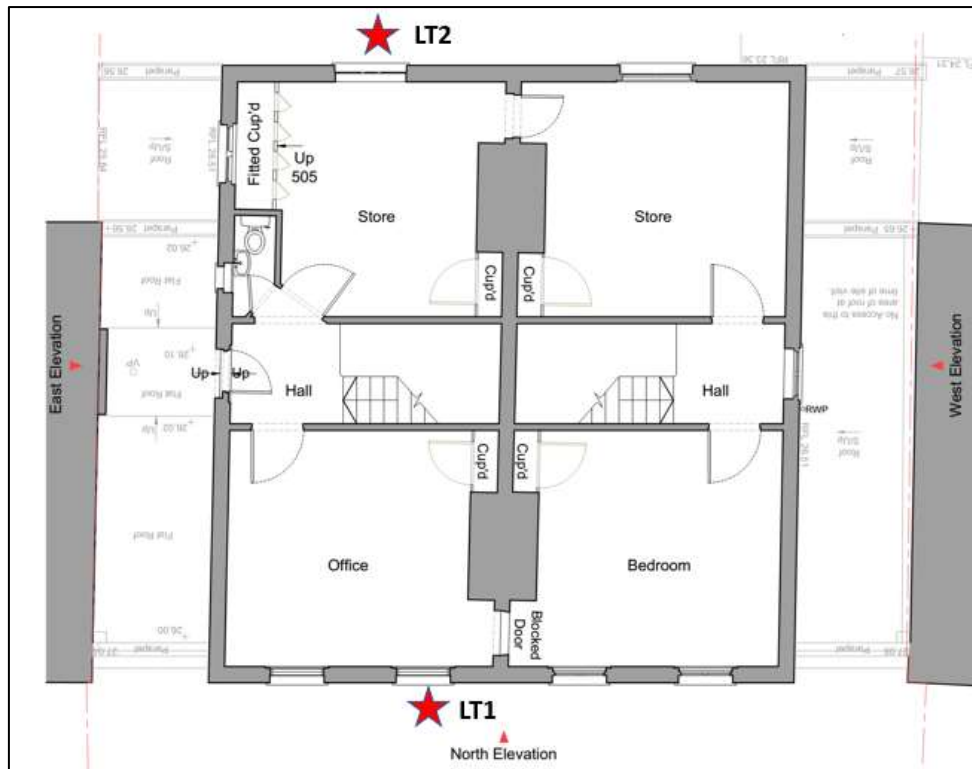


Figure 4. Second Floor Plan of Measurement Locations



Figure 5. Images of Rear and Front Sound Level Meters

3.2 Outside to Inside Sound Transfer

To determine the performance of the building façade and to be able to deduce further calculations, a number of measurements were made on the same façade, at the same height, but internally in order to carry out a straight deduction for the same time period. The clocks of the sound level meters used were synchronised allowing a comparable duration/level difference. For completeness, the rooms selected for internal measurement were separate to those rooms containing the external monopoles, to ensure that sound energy was not able to contaminate the readings through partially open windows.

3.3 Vertical Sound Insulation Testing

Whilst present on site, a number of sound insulation tests in accordance with Approved Document E were carried out to determine the baseline performance of the separating floors at ground and first floor level.

4 Methodology and Assessment Standards

4.1 Methodology

Given that both front and rear facades were capable of simultaneous measurement, it is not necessary to consider noise modelling. The results can be reviewed for both $L_{Aeq, 16 \text{ hour}}$ daytime and $L_{Aeq, 8 \text{ hour}}$ night time periods. The predicted internal sound levels can be further ascertained by using the transfer function from outside to inside which was measured whilst on site.

4.2 Applicable Assessment Standards

Whilst Table 4 of BS8233:2014 will be used for continuous anonymous sound levels, the recently published ProPG2017 will be used in respect of L_{AMax} levels at night inside the bedrooms.

The rigorous calculation methodology as described in G2 of BS8233:2014 will be applied to determine the glazing required to protect the future occupants.

Building Regulations Approved Document E will also be referenced for the airborne/impact testing between healthcare settings/rooms and the residential spaces.

5 Results of the Sound Surveys

As previously stated, the external measurement positions were façade positions given their proximity to the North and South facades. The measured dataset has been converted to freefield data by the subtraction of 3dB(A).

5.1 Oxford Road – LT1 Unattended Data

Logarithmically Averaged Day and Night time Periods (External - Freefield)-dB(A)			
$L_{Aeq, 16 \text{ hour- 07:00-23:00}}$		$L_{Aeq, 8 \text{ hour 23:00-07:00}}$	
Day 1	69.6	Night 1	61.0
Day 2	68.4	Night 2	59.5
Day 3	68.7	Night 3	62.1
Day 4	68.3	Night 4	60.7
Day 5	68.6	Night 5	61.5
Day 6	68.4	Night 6	61.0
Day 7	68.1	Night 7	60.5
Arithmetic Average	68.6	Arithmetic Average	60.9

Figure 6. Oxford Road (North Facade) - LT1 - Freefield Measured Data

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-13dB)						
Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Night 7
96	95	96	96	96	96	96

Figure 7. Oxford Road Overnight Data (Freefield), with likely open window (-13dB(A)) and L_{Amax} event occurrences

Given that only living rooms will overlook the Oxford Road façade, there is not a requirement to consider any L_{AFmax} assessment, as these relate to bedrooms only, and these are located on the Goldsmid Road façade (see 5.2 below).

5.2 Goldsmid Road – LT2 Unattended Data

Logarithmically Averaged Day and Night time Periods (External - Freefield)-dB(A)			
L_{Aeq} , 16 hour- 07:00-23:00		L_{Aeq} , 8 hour 23:00-07:00	
Day 1	51.4	Night 1	40.0
Day 2	49.4	Night 2	39.2
Day 3	51.9	Night 3	41.2
Day 4	50.2	Night 4	41.9
Day 5	51.9	Night 5	42.8
Day 6	49.6	Night 6	42.7
Day 7	49.9	Night 7	42.2
Arithmetic Average	50.6	Arithmetic Average	41.4

Figure 8. Goldsmid Road (South Facade) – LT2 - Freefield Measured Data

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-13dB)						
Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Night 7
8	13	10	7	9	15	9

Figure 9. Goldsmid Road Overnight Data (Freefield), with likely open window (-13dB(A)) and L_{Amax} event occurrences

No. of Occurrences of L_{Amax} between 23:00-07:00 hours above 45dB L_{Amax} (SRI-15dB)						
Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Night 7
5	7	8	5	7	9	5

Figure 10. Goldsmid Road Overnight Data Freefield, with SRI sufficient to reduce L_{Amax} events (45dB L_{AFmax}) to below 10 per night as per section 2.5

5.3 Sound Transfer (Outside to Inside Simultaneous Measurement)

The original external survey positions were used as well as a sound level meter with a synchronised clock to measure exactly the same time period. The measurements were made in adjacent rooms on the same façade with all doors and windows closed. Note that freefield data to internal measured data has been compared.

Façade	Location	External Freefield Measurement ($L_{Aeq, 5minutes}$)	Internal Room Measurement on same level ($L_{Aeq, 5minutes}$)	Measured Difference (dB(A))
Front	Oxford Road	66.6	36	30.6
Rear	Goldsmid Road	48.2	27.8	20.4
All measurements are Fast Time Weighted and A Weighted.				

Figure 11. Outside to Inside Measured Data

5.4 Sound Insulation Performance of Separating Vertical Spaces

When collecting the survey data and when the surgery was not in use, a vertical airborne sound insulation test was carried out between ground floor and first floor and basement as well as a vertical impact test from the ground floor to the existing basement bedroom. The test methodology was commensurate with Building Regulations Approved Document E. The results are as follows and are discussed further in section 6.

- Airborne Ground Floor to First Floor – 41dB $D_{nT,w} + C_{tr}$
- Airborne Ground Floor to Basement Bedroom – 37 dB $D_{nT,w} + C_{tr}$
- Impact Ground Floor to Basement Bedroom – 62dB $L_{nT,w}$

5.5 Measured Data Summary

A data summary is presented of the North and South Facades, their measured SRI from outside to inside as well as the SRI required to prevent no more than ten events per night inside a bedroom exceeding 45dB L_{AFmax} . Given that there are no bedrooms on the Northern façade overlooking Oxford Road, the SRI for L_{AFmax} events has been annotated as N/A -Not Applicable.

Measurement Summary				
Location	External Freefield Measured Data Daytime ($L_{Aeq, 16 hour}$)	External Freefield Measured Data Night Time ($L_{Aeq, 8 hour}$)	Measured Façade Performance (SRI)	SRI Required to reduce L_{AFMax} (45dB) events to below 10 events per night
Front Façade	68.6	60.9	30.6	N/A
Rear Façade	50.6	41.4	20.4	15
All measurements are Fast Time Weighted, A Weighted and in dB(A)				

Figure 12. Data Summary

6 Discussion

6.1 General

The measured data collected over seven days and seven nights remains relatively stable with only a 2dB difference in the daytime measured data at the North façade and a 3dB difference in the daytime measured sound pressure levels to the rear.

Similarly, the night time measured sound pressure levels have only 3dB difference for the North facade and 3dB for the rear façade.

The quieter façade is definitely that of the rear South façade overlooking Goldsmid Road which shows between 18dB to 19.5dB reduction between the levels measured at Oxford Road to Goldsmid Road facades. The measurements support the principle of good acoustic design with the bedrooms being located to the rear façade and living areas on the North façade.

The measurement between inside and outside to determine the performance of the façade was noted to differ between the front and rear facades. This may be due to the types of windows and their fit and materials (ie timber vs metallic crittal windows), the ratio of glazing to brickwork façade and the absorption level (ie soft furnishings) inside the rooms measured.

6.2 Comparison with Historic Acoustic Report for Public House Site Opposite

It was noted on the planning portal for Reading Council that Acoustic Design Technology had produced a report dated 10 May 2018 for a mixed use building which sees the demolition of the pub (Battle Inn/Royal Public House) opposite the application site. Position 1 which was overlooking Oxford Road recorded 69dB $L_{Aeq, 16 \text{ hour}}$ and 65dB $L_{Aeq, 8 \text{ hour}}$ for the daytime and night time periods respectively. As façade measurements, these require a 3dB subtraction to ensure a like for like comparison with the data measured herein. Therefore, the daytime element was 66dB $L_{Aeq, 16 \text{ hour}}$ and the night time period, 62dB $L_{Aeq, 8 \text{ hour}}$.

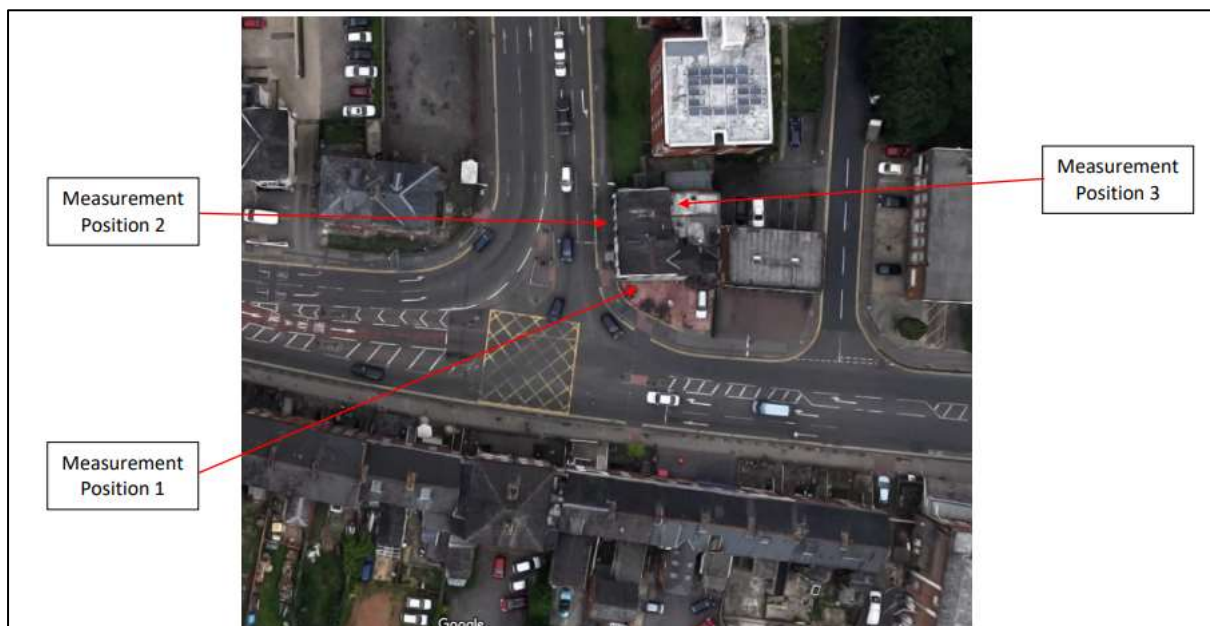


Figure 13. Extract from ADT Consultants Report for Pub Development Opposite

The measured data therefore correlates well to that measured across the road in 2018 with only a 1dB difference at night and 2.6dB difference for the daytime. It is however noted that the Acoustic Design Technology measurement period was just under 24 hours, whereas the survey undertaken by AASL was more robust and had a duration of seven days and nights. Attention is drawn to the 3dB variation/difference in daytime measured sound pressure levels as discussed in 6.1 above.

6.3 ProPG2017 Initial Site Risk Assessment

In line with the requirements of ProPG2017, an initial site risk assessment is presented to detail to stakeholders and decision makers the level of risk associated with external freefield noise levels at the site. Please note that this presents a worst-case illustration without any mitigation measures applied. To prevent any misinterpretation, the habitable areas have been labelled on the left-hand diagrammatic arrow to detail that for bedrooms, the risk is negligible to low. It should be remembered also that this is a converted property which is a listed building and not a new build.

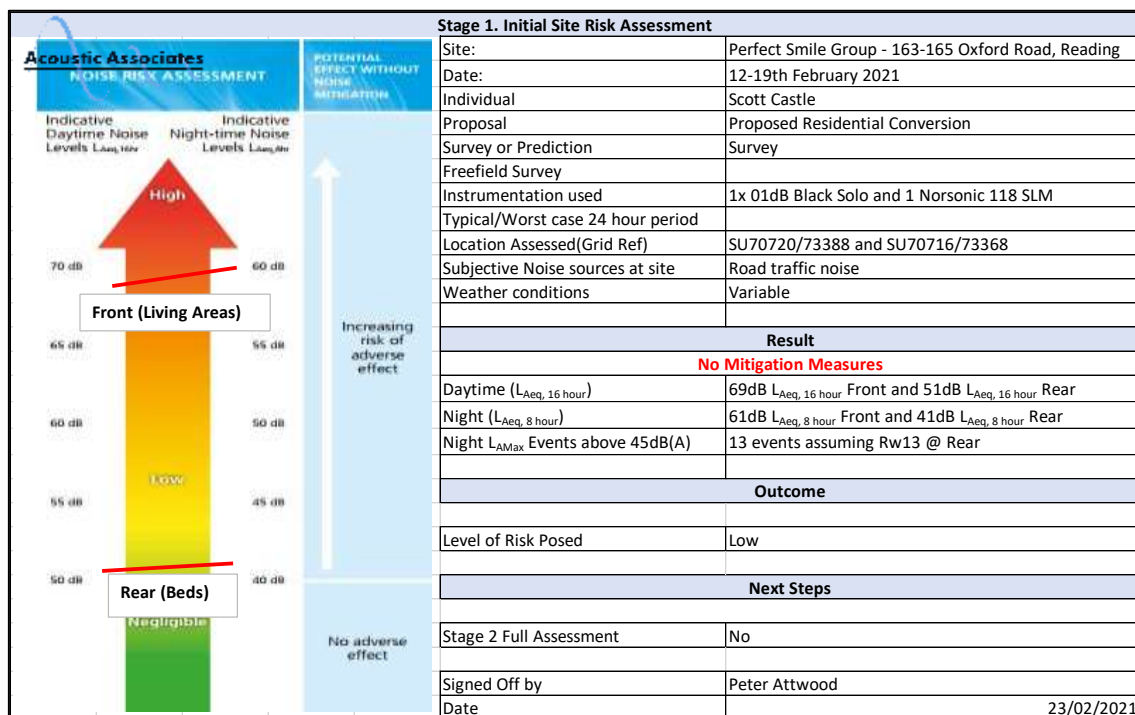


Figure 14. ProPG 2017 Initial Site Risk Assessment

6.4 Ventilation and Windows

Using the average freefield measured data for both the front and rear of the property, an assessment may be made of whether future residents are able to rely on open windows for ventilation purposes. As seen in Figure 15 below, for the living room areas located on the North façade, this is not likely to be the case and alternative ventilation provision will be required. Whilst residents ultimately retain the choice and freedom to open windows, the internal soundscape as a result of the road traffic noise will increase and be above the criteria stated within BS82233:2014. It is important to note that there is no performance criterion stated for short term purge ventilation.

For residents at the rear, whilst windows may be opened for the continuous night time sound level, having an open window for a bedroom at night will also be impacted by L_{AFMax} events. Attention is drawn to Figure 9 in section 5.2 where the L_{Amax} event numbers are predicted with an open window to exceed the 10 events permissible per night.

Assessment of Whether Windows May be Opened for Background Ventilation						
Location	Average External Daytime Sound Pressure (Freefield)	Open Window (-13dB)	Closed Window*	BS8233:2014 Daytime Criterion	Openable Windows	Rigorous Calculation Required
Front Façade (Oxford Road)	68.6	55.6	38	35 dB $L_{Aeq, 16 \text{ hour}}$	No	Yes
Rear Façade (Goldsmid Road)	50.6	37.6	30.2	35 dB $L_{Aeq, 16 \text{ hour}}$	No	Yes
Location	Average External Night Time Sound Pressure (Freefield)	Open Window (-13dB)	Closed Window*	BS8233:2014 Night Time Criterion	Openable Windows	Rigorous Calculation Required
Rear Façade (Goldsmid Road)	41.4	28.4	21	30dB $L_{Aeq, 8 \text{ hour}}$	Yes	No
Location	No more than 10 events exceeding 45dB L_{AFMax} Internally (Bedroom)	Achieves ProPG2017 with an Open Window (-13dB)	Achieves ProPG2017 with a Closed Window*	ProPG 2017 Overnight Criterion	Openable Windows	Rigorous Calculation Required
Rear Façade (Goldsmid Road)		15 events (No)	2 events (Yes)	Closed Windows Only	No	No
*Closed Windows have used the measured façade performance for North and South exposures, ie 30.6dB (North) and 20.4dB (South)						
All measured External Sound Pressure Levels are Freefield, Fast Time Weighted and dB(A)						

Figure 15. Assessment of Window Opening as a means of background ventilation

Figure 15 above has used measured performance values (from Figure 11 above) of the closed windows for both the North and South façades. In summary, the opening of windows may not be relied upon exclusively for background ventilation. As previously stated, and to reiterate, this does not mean that residents are unable to open windows, as they may do so at will, but in doing so, the internal soundscape will increase as a result of the window being opened and exceed the listed criteria of BS8233:2014 for living room and BS8233:2014 and ProPG2017 for bedroom settings.

6.5 Required Façade Performance

6.5.1 Oxford Road Façade

Given that only the living rooms will overlook the Oxford Road façade, there is a requirement that these meet the daytime performance criterion of 35dB $L_{Aeq, 16 \text{ hour}}$. As a worst case measured (and rounded) 70dB $L_{Aeq, 16 \text{ hour}}$, there will be a requirement of 35dB SRI.

6.5.2 Goldsmid Road Façade

Given that only the bedrooms will overlook the rear, the requirement to be met internally for the daytime is 35dB $L_{Aeq, 16 \text{ hour}}$ and for night time, 30dB $L_{Aeq, 8 \text{ hour}}$. Whilst these consider the continuous external sound pressure levels, consideration for bedrooms must also incorporate L_{Amax} events and use whichever is the higher of the criteria.

The highest measured daytime at the rear was 52dB $L_{Aeq, 16 \text{ hour}}$. The SRI to meet 35dB $L_{Aeq, 16 \text{ hour}}$ will be 17dB

The highest measured Night time at the rear was 43 dB $L_{Aeq, 8 \text{ hour}}$. The SRI to meet 30dB $L_{Aeq, 8 \text{ hour}}$ will be 13dB

The requirement to prevent L_{Amax} events at the rear bedrooms exceeding 10 events above 45dB L_{Amax} internally is 15dB.

The required rear façade performance is therefore a minimum of 17dB.

6.6 Required Façade Performance vs Measured Performance

Further to section 6.5 above and the measured performance of the façade carried out on site, Figure 16 below details where the improvements are necessary. Unsurprisingly, it is the living room facades overlooking the busier Oxford Road which require a 4.4dB (rounded to at least 5dB) uplift to protect residents in the living room areas.

Location	Measured SRI Performance	Required SRI Performance	Improvement Necessary
Front Façade (Oxford Road)	30.6	35	4.4
Rear Façade (Goldsmid Road)	20.4	17	N/A

Figure 16. Comparison of Measured and Required SRI Performance

6.7 Sound Insulation Performance

Section 5.4 above detailed the measured baseline performance for the separating partitions for the ground floor and first floor areas, assessed using both airborne and impact sounds. It must be remembered that as a grade 2 listed building, whilst Approved Document E lists criteria to be achieved, there is a trade-off between maintaining historic integrity and sound insulation and potential relaxations.

Sound insulation is governed by Approved Document E “Resistance to the passage of sound”. In this particular instance, with a ground floor commercial use to a residential first floor above and potentially below, then vertical airborne sound will apply to the first floor flat from the dental surgery at ground floor and both airborne and impact will apply from the ground floor surgery to the basement residential setting below.

In circumstances with a mixed tenure, ie commercial at ground floor and residential above and below, it is normal to seek an increased sound insulation performance above building regulations. This is reflected in section 0.8 of the building regulations, as shown below in Figure 18.

Whilst ordinarily, one would seek to achieve compliance with the criterion of a conversion for such a property, the fact that it is a listed building is recognised within the ADE and is discussed in Figure 18 below. Principally, there is a balance to be struck in preserving historic features and yet improving sound insulation. There is also specific reference made to liaison with the conservation officer.

0.7 In the case of some historic buildings undergoing a material change of use, it may not be practical to improve the sound insulation to the standards set out in Tables 1a and 1b. The need to conserve the special characteristics of such historic buildings needs to be recognised¹, and in such work, the aim should be to improve sound insulation to the extent that it is practically possible, always provided that the work does not prejudice the character of the historic building, or increase the risk of long-term deterioration to the building fabric or fittings. In arriving at an appropriate balance between historic building conservation and improving sound insulation it would be appropriate to take into account the advice of the local planning authority's conservation officer. In such cases it will be reasonable to improve the sound insulation as much as is practical, and to affix a notice showing the sound insulation value(s) obtained by testing in accordance with Regulation 41 or 20(1) and (5), in a conspicuous place inside the building.

0.8 The performance standards set out in Tables 1a and 1b are appropriate for walls, floors and stairs that separate spaces used for normal domestic purposes. A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice may be needed to establish if a higher standard of sound insulation is required and, if so, to determine the appropriate level.

Figure 17. Extract from Approved Document E – Historic Buildings

Whilst there will clearly be refurbishments, liaison is suggested with the local planning authority conservation officer. As a dental surgery which specialises in sedation, significant sound generating sources are not anticipated.

7 Recommended Mitigation Measures

7.1 Glazing

From the proposed plans, the client proposes refurbishment of the windows.

Specifically, there is a requirement to upgrade the Oxford Road façade to ensure that the required protection is provided to future residents in the living room areas.

The provision of secondary glazing which utilises the existing outer panes and the reveal depth of the window setting with an additional layer of rear glass will improve the sound reduction index of the Northern Oxford Road façade. As a Grade II listed building, it is likely that there will be dialogue with the conservation/heritage officer in due course, but such a course of action will increase the attenuation provided by the windows as the weakest part of the façade as well as the retention of the outer frames (if indeed this is considered desirable).

7.2 Ventilation

It is noted that open windows may not be relied upon for background ventilation and it is strongly recommended that ventilation is considered which the future residents are capable of controlling. The following calculations in 7.3 have applied a passive through the wall ventilator which is commercially available from Greenwood and has a high attenuation specification of $D_{n,e,w}$ of 55dB(A)



Figure 18. Greenwood MA3051 Through The Wall Ventilator

7.3 Rigorous Calculations

A rigorous calculation to demonstrate how the living room façade (Flat 5) is performing at present has been undertaken and what improvements may be achieved to improve the sound reduction index.

7.3.1 Current Performance

The dimensions of the proposed second floor apartment (Flat 5) have been applied to a rigorous calculation to achieve as close as possible as to what was measured on site, ie 30.6dB SRI. This has used a 4mm window and no trickle vent. The rigorous calculation has used 70 dB $L_{Aeq, 16 \text{ hour}}$ as the freefield external sound level, as 69.6 dB $L_{Aeq, 16 \text{ hour}}$ has been measured as a worst case day. The SRI is slightly increased at 32 as opposed to 30.6 dB measured. Note that the internal noise level exceeds BS823:2014 daytime levels of 35dB $L_{Aeq, 16 \text{ hour}}$.

Non Frequency Dependent Variables			Key for Table Below					
Term	Derivation	Value	R_{wi}	Sound Reduction of Window (Octave)				
A_o	Given in BS EN 20140-10 = 10 (m ²)	10	R_{ew}	Sound Reduction Index of External Wall (Octave)				
S_f	Total Facade Area (m ²)	10.71	R_{rr}	Sound Reduction Index of Roof/Ceiling (Octave)				
S_{wi}	Window Area (m ²)	2.4	A	Equivalent Absorption Area of Rx Room				
S_{ew}	External Wall Area (m ²)	8.31	$D_{n,e}$	Insulation of Trickle Vent (BS EN 20140-10)				
S_{rr}	Ceiling Area (m ²)	21.1						
S	Total Area sound enters the room (m ²)	31.8						

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
$L_{eq,ff}$	Free-Field External Noise Level	72	68	66	66	63	56
$D_{n,e}$	No Vent	100	100	100	100	100	100
R_{wi}	4	20	22	28	33	34	28
R_{ew}	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
R_{rr}	Tiles on felt, pitched roof, lath and plaster ceiling	47	47	47	47	47	47
A	Equivalent Absorption Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details							
Term From Equation Below	Octave Band Centre Frequency						
	125	250	500	1000	2000	4000	
$L_{eq,ff}$	72	68	66	66	63	56	
$A_o/S \cdot 10^{(-D_{n,e}/10)}$	3.1447E-11	3.14E-11	3.14E-11	3.14465E-11	3.14465E-11	3.14465E-11	
$S_{wi}/S \cdot 10^{(-R_{wi}/10)}$	0.00075472	0.000476	0.00012	3.78255E-05	3.00458E-05	0.000119615	
$S_{ew}/S \cdot 10^{(-R_{ew}/10)}$	2.0757E-05	3.29E-05	1.04E-05	1.64882E-06	2.61321E-07	8.26369E-08	
$S_{rr}/S \cdot 10^{(-R_{rr}/10)}$	1.3239E-05	1.32E-05	1.32E-05	1.3239E-05	1.3239E-05	1.3239E-05	
$10 \log_{10}(S/A)+3$	7.61034435	6.562991	5.983071	5.983071373	6.263358609	6.263358609	
$L_{eq,2}$	48.5795369	41.74245	33.54423	29.20227427	25.65285935	23.49979296	
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1	
A-Weighted L_{eq}	32.4795369	33.14245	30.34423	29.20227427	26.85285935	24.49979296	

A-Weighted Level Outside	70
BS8233 Predicted Internal A-Weighted Level	38
Predicted Building Envelope SRI	32

Figure 19. Likely Current Configuration (Flat 5 Living Room)

7.3.2 Proposed Upgrade

By applying a high specification through the wall ventilator which is available off the shelf from Greenwood, and the use of secondary glazing, the sound reduction index of the façade has increased by 6dB to 38dB SRI which is in excess of that required for the living room areas. Additionally, given the living room space, two ventilators have been provided by adjusting the spectral performance by $10 \cdot \log(2)$ reduction.

The predicted internal sound pressure level is now below BS8233:2014 for the L_{Aeq} , 16 hour daytime period.

Non Frequency Dependent Variables			Key for Table Below				
Term	Derivation	Value	R_{wi}	Sound Reduction of Window (Octave)			
A_o	Given in BS EN 20140-10 = 10 (m^2)	10	R_{ew}	Sound Reduction Index of External Wall (Octave)			
S_f	Total Facade Area (m^2)	10.71	R_{rr}	Sound Reduction Index of Roof/Ceiling (Octave)			
S_{wi}	Window Area (m^2)	2.4	A	Equivalent Absorbtion Area of Rx Room			
S_{ew}	External Wall Area (m^2)	8.31	$D_{n,e}$	Insulation of Trickle Vent (BS EN 20140-10)			
S_{rr}	Ceiling Area (m^2)	21.1					
S	Total Area sound enters the room (m^2)	31.8					
Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
$L_{eq,ff}$	Free-Field External Noise Level	72	68	66	66	63	56
$D_{n,e}$	MA3015	43.7	43.3	46.0	52.7	63.3	66.3
R_{wi}	6_100_4	26	34	44	56	53	52
R_{ew}	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
R_{rr}	Tiles on felt, pitched roof, lath and plaster ceiling	47	47	47	47	47	47
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00
BS8233 Calculation Details							
Term From Equation Below	Octave Band Centre Frequency						
	125	250	500	1000	2000	4000	
$L_{eq,ff}$	72	68	66	66	63	56	
$A_o/S \cdot 10^{(-D_{n,e}/10)}$	1.3446E-05	1.47E-05	7.92E-06	1.69279E-06	1.47436E-07	7.38929E-08	
$S_{wi}/S \cdot 10^{(-R_{wi}/10)}$	0.00018958	3E-05	3E-06	1.89576E-07	3.78255E-07	4.76194E-07	
$S_{ew}/S \cdot 10^{(-R_{ew}/10)}$	2.0757E-05	3.29E-05	1.04E-05	1.64882E-06	2.61321E-07	8.26369E-08	
$S_{rr}/S \cdot 10^{(-R_{rr}/10)}$	1.3239E-05	1.32E-05	1.32E-05	1.3239E-05	1.3239E-05	1.3239E-05	
$10\log_{10}(S/A)+3$	7.61034435	6.562991	5.983071	5.983071373	6.263358609	6.263358609	
$L_{eq,2}$	43.3581776	34.14991	27.3694	24.2284519	20.73270182	13.68466447	
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1	
A-Weighted L_{eq}	27.2581776	25.54991	24.1694	24.2284519	21.93270182	14.68466447	
A-Weigted Level Outside		70					
BS8233 Predicted Internal A-Weighted Level		32					
Prediced Building Envelope SRI		38					

Figure 20. Potential Upgrade Performance (Flat 5 Living Room)

8 Conclusion

External noise levels were measured on site using unattended measurements between 12th to 19th February 2021. Two class 1 sound level meters were used to assess the front façade (Oxford Road) and the rear façade (Goldsmid Road) over a 7-day period. The assessment duration also deliberately included a weekend to ensure that any variation in the soundscape was captured. The building is a Grade II listed building and currently includes a residential apartment at the second floor.

The dominant noise source is that of Oxford Road and the associated road junctions which are traffic light controlled to the North. There is an approximate 19.5dB difference between the front and rear of the application building and good acoustic design has sensitively located the bedroom environments on the rear and quieter facades.

The assessment has considered the requirements of both BS8233:2014 and ProPG2017 on the proposed changes to the building. The assessment has detailed that the living room areas which overlook the noisier façade of Oxford Road require a small uplift in the façade performance and also, residents, whilst being free to open windows of their choosing, will likely require an alternative method of ventilation to reduce noise break in.

The use of secondary glazing and through the wall ventilators has shown that the site is capable of being developed into residential flats without any adverse impact on the future occupants and with BS8233:2014 and ProPG2017 criteria achieved.

The application should not therefore be withheld planning consent on noise grounds.