



PLANNING NOISE ASSESSMENT

CADOGAN HOUSE, READING

PROJECT MOLE LTD.

AUGUST 2018

PLANNING NOISE ASSESSMENT CADOGAN HOUSE, READING

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1 INTRODUCTION

Anderson Acoustics Ltd was commissioned by Project Mole Ltd. in January 2017 to undertake a noise assessment for the proposed development on Cadogan House, Reading.

The development involves the change of use of an existing office space to provide 39 apartments across the ground and first floors.

This assessment has been carried out to provide advice on the control of external noise via the building envelope to safeguard the amenity of future occupants.

Noise units, acoustic terminology and environmental noise criteria relevant to the assessment have been presented and briefly discussed in Section 2 of this report.

2 NOISE UNITS, POLICY AND CRITERIA

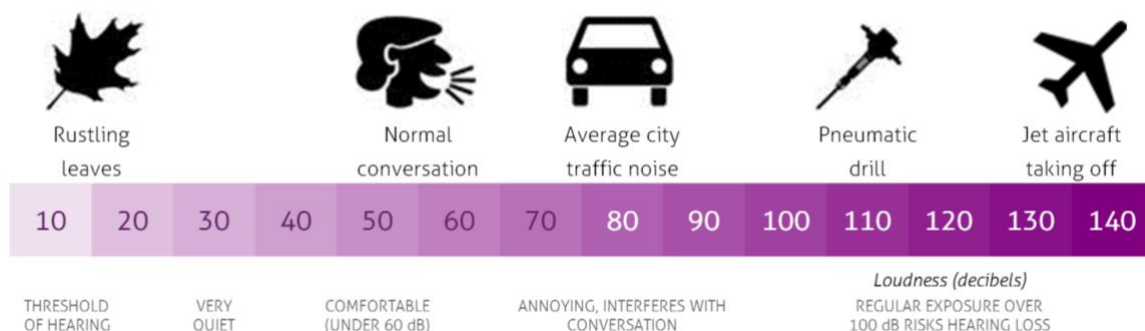
2.1 Noise Units

There is a ten million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Noise is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB). Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz, however its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure noise is therefore weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A).

It is generally accepted that under normal conditions humans are capable of detecting changes in steady noise levels of 3 dB, whilst a change of 10 dB is perceived as a doubling or halving of the noise level. An indication of the range of noise levels commonly found in the environment is given below.

Figure 2.1: Typical noise levels



A number of different indices are used to describe the fluctuations in noise level over certain time periods. The main indices include:

- $L_{A90,T}$** This is the noise level exceeded for 90% of the measurement period and provides a measurement of the quieter 'lull' periods in between noise events. It is often referred to as the background noise level.
- $L_{Aeq,T}$** This is the "equivalent continuous A weighted sound pressure level" and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period. It is often used for measuring all sources of noise in the environment, which can be referred to as the ambient noise.
- $L_{Amax,F}$** This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

Reference is often made to acoustic measurements being undertaken in 'free-field' or 'façade' locations. Free-field measurements represent a location away from vertical reflecting surfaces, normally by at least 3.5 metres. A façade measurement is undertaken, or calculated to a position 1 metre from an external façade and a correction of up to 3 dB can be applied to account for the sound reflected from the façade. This latter position is often used when assessing the impact of external noise affecting residents inside properties.

2.2 Noise Policy and Criteria

2.2.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) [1] was published on 15 March 2010. It sets out the long-term vision of the Government's noise policy, which is to promote good health and a good quality of life through the management of noise within the context of sustainable development.

The NPSE sets out the following aims:

"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."

The NPSE describes a number of effect levels that may be used to define effects in the context of noise policy, as follows:

- **NOEL – No Observed Effect Level** - 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.
- **LOAEL – Lowest Observed Adverse Effect Level** - This is the level above which adverse effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level** - This is the level above which significant adverse effects on health and quality of life

In March 2014, further guidance on interpreting the effect levels was published on the Government's Planning Practice Guidance. This includes a table that summarises noise exposure hierarchy, noting this is based on the likely average response of a population. This table is reproduced in Table 2.1 overleaf.

Table 2.1 Noise exposure hierarchy and effect levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.2.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) [2] was published on 27 March 2012 and subsequently updated on 24 July 2018.

The NPPF sets out how the Government's planning policies should be applied. In terms of the detail of policies on environmental issues such as noise, the intention is for Local Planning Authorities to set their own guidance. This will form part of or be referred to in the relevant Local Plan.

2.2.3 Reading Borough Council – Local Plan May 2017

Reading Borough Council outlines its planning policies for residential developments within the Core Strategy document [3], adopted in January 2008 and revised in January 2015. It specifically refers to external noise ingress for residential developments and also of conversion properties, in policy CS34. This is reproduced below:

Policy CS34 Pollution & Water Resources

“Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.”

The adopted policy CS34 outlines that noise ingress into the property, should be assessed in terms of its suitability for residential purposes and where necessary measures are to be advised and implemented to reduce this to an acceptable level. In order this assessment, reference has been made to the following relevant guidance.

The draft Local Plan [4], which is under the final stages of submission, includes similar requirements under draft Policy EN16 Pollution & Water Resources; and refers to the Professional Practice Guide on Planning and Noise (ProPG) as the main relevant guidance document when designing residential development impacted by transportation noise.

2.3 Relevant Guidance

2.3.1 ProPG: Planning & Noise

ProPG [5] (Professional Practice Guidance: Planning and Noise) has been jointly developed by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH) to guide Local Planning Authorities (LPA's) and Practitioners in assessing the suitability for residential development on sites predominantly exposed to airborne transport noise.

ProPG has introduced a sequential 2-stage approach allowing for early consideration of noise issues at Stage 1 followed by more detailed consideration of noise issues at Stage 2, should this be necessary.

Stage 1 introduces the concept of noise risk categories ranging from Negligible Risk to High Risk to help LPA's in making accelerated straightforward decisions for low risk sites and to provide guidance for more detailed consideration associated with challenging higher risk sites.

Following the outcome of Stage 1, Stage 2 then applies to sites assessed as low to high risk. This stage should not be necessary for sites assessed as negligible risk.

Stage 2 requires consideration be given to four key elements,

- Element 1: Good Acoustic Design Process
- Element 2: Internal Noise Level Guidelines
- Element 3: External Amenity Area Noise Assessment
- Element 4: Other Relevant Issues

Further details on these elements are discussed in the acoustic design section of this report.

Table 2.2 overleaf provides a summary of ProPG's noise risk categories and their associated fee-field noise levels, along with the assessment implications.

Table 2.2: Stage 1 - Initial Site Noise Risk Assessment

Risk Category	Indicative Daytime Noise Levels $L_{Aeq,16hr}$	Indicative Night-time Noise Levels $L_{Aeq,8hr}$	Pre-Planning Application Advice
Negligible Risk	< 50 dB	< 40 dB	Indication that the development site is likely to be acceptable from a noise perspective and application need not normally be delayed on noise grounds.
Low Risk	50 - 60 dB	40 - 50 dB	Indication that the development site is likely to be acceptable provided a good acoustic design process is followed and is confirmed in a detailed Acoustic Design Statement confirming how noise will be mitigated.
Medium Risk	60 - 70 dB	50 - 60 dB	
High Risk	> 70 dB	> 60 dB	Indication that the development site may be refused on noise grounds unless a good acoustic design process and detailed Acoustic Design statement can demonstrate the significant noise risk can be mitigated.

Notes

- Noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.
- Noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present, but not dominant.
- $L_{Aeq,16hr}$ is for daytime 0700-2300, $L_{Aeq,8hr}$ is for night-time 23:00 to 07:00.
- An indication that there may be more than 10 noise events at night (2300-0700) with $L_{Amax,F} > 60$ dB means the site should not be regarded as negligible risk.

2.3.2 British Standard 8233

British Standard BS 8233: 2014: Sound insulation and noise reduction for buildings – Code of practice [6] provides guideline values for internal noise levels within a number of building types including residential dwellings.

In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 2.3.

Table 2.3: BS 8233 Internal Noise Levels

Activity	Location	Daytime	Night-time
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 $L_{Aeq, 8hour}$

Notes: Daytime assessment period – 07:00 to 23:00 hrs
Night-time assessment period – 23:00 to 07:00 hrs

BS 8233 also provides guidance on calculating the sound insulation performance requirements for the external envelope or facade of a building where this is made up of a number of different elements.

2.3.3 World Health Organisation Guidelines

The following guideline values for community ambient noise levels in specific environments are presented in the World Health Organization (WHO) Guidelines for Community Noise [7], shown in Table 2.4 below.

Table 2.4: WHO Guideline Noise Values

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB $L_{Amax,F}$
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outdoor amenity	annoyance, daytime and evening	50-55	16	-

The 45 dB $L_{Amax,F}$ criterion applies to “single sound events” within bedrooms at night. This guideline is generally interpreted as the value that individual noise events should not normally exceed. We have interpreted this as the level that should not be exceeded for ninety percent of the “single sound events” throughout a night time period.

2.3.4 Summary of environmental noise criteria

Having considered the above criteria a design limit of 35 dB $L_{Aeq,T}$ is to be achieved in living rooms and 30 dB $L_{Aeq,T}$ in bedrooms at night. In addition, individual noise events should not normally exceed 45 dB $L_{Amax,F}$ within bedrooms at night. This is deemed suitable to satisfy Reading Borough Council’s policy CS34 in our professional opinion.

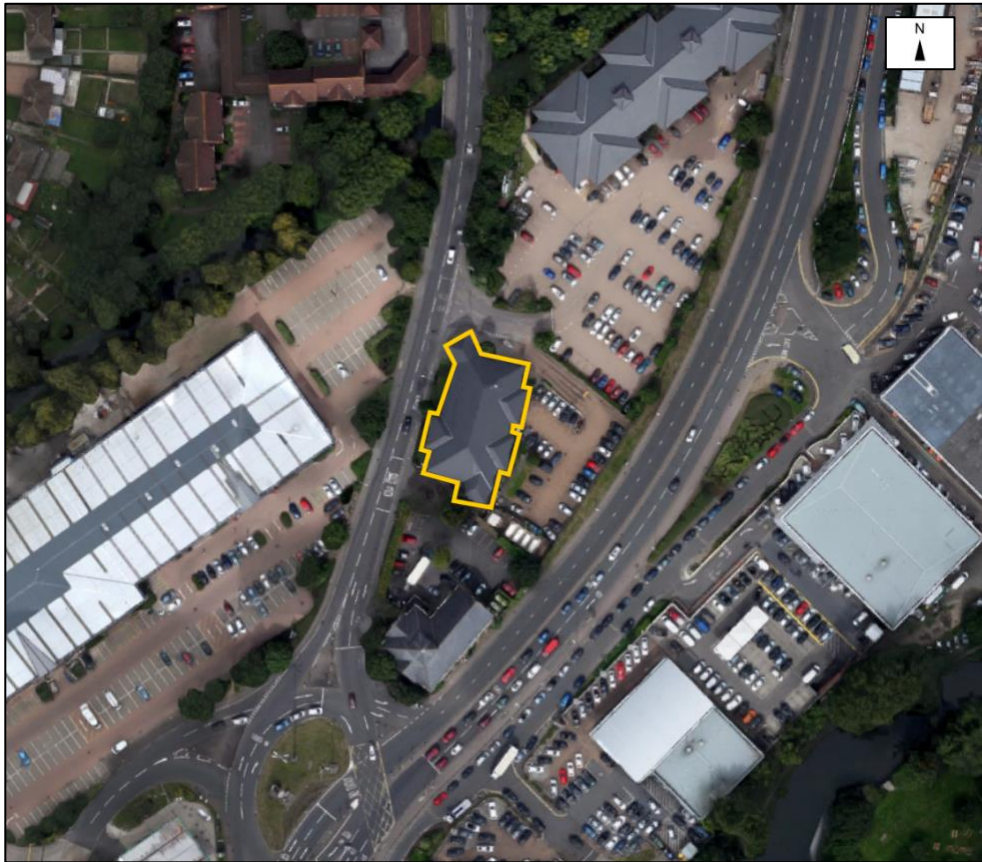
3 SITE DESCRIPTION

3.1 Existing Site

The site location is shown in Figure 3-1, and is currently known as Cadogan House, Rose Kiln Lane, Reading RG2 0HP.

The development is located in between Rose Kiln Lane and the A33, and is surrounded by several other commercial premises.

Figure 3-1: Development location in relation to surroundings



External walls are constructed of solid brickwork (assumed 225 mm thick) with double glazed windows and separating floors of solid concrete slab (assumed to be 150 mm thick). Offices are currently located on both the ground and the first floor.

Observations during the site visits indicated that the noise climate across the entire site was governed by road traffic on Rose Kiln Lane to the west of the site, and road traffic on the A33 to the east of the site. Noise from commercial premises surrounding the site was deemed to be of minor noise contribution compared to nearby road traffic noise.

3.2 Proposed Development

The development involves the change of use of an existing office space to 39 apartments across the ground and first floors.

Proposed floor plans are shown in Figures 3.2 and 3.3.

Figure 3-2: Ground floor proposed plans containing studio apartments

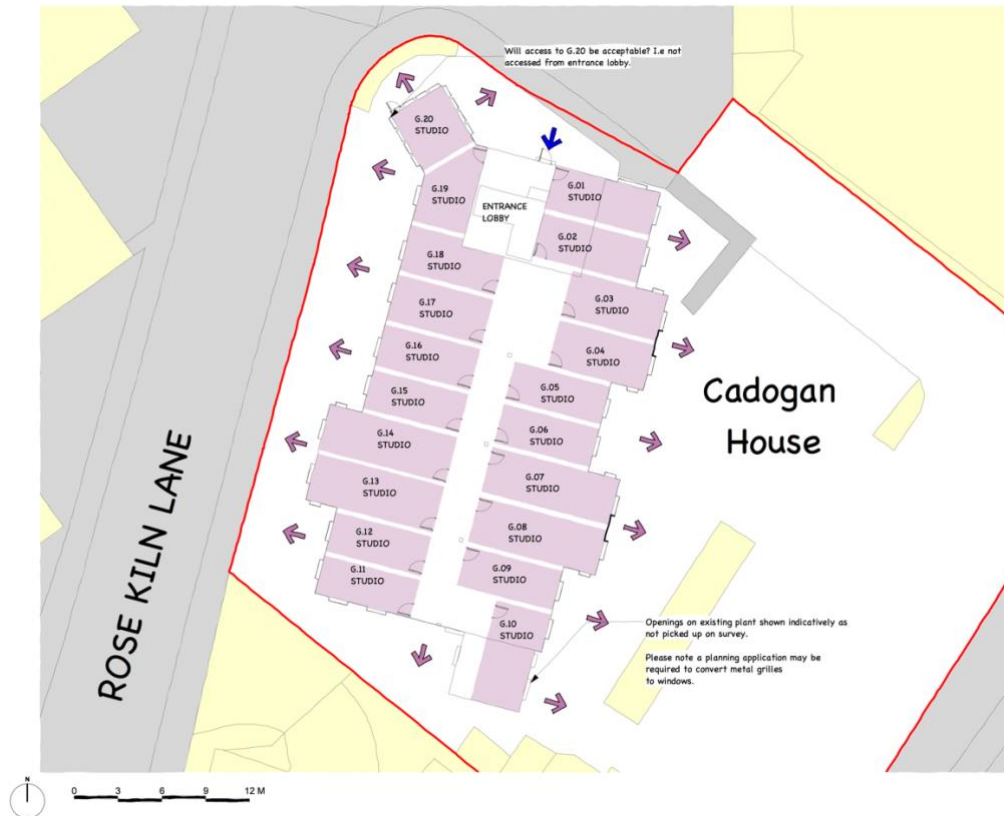
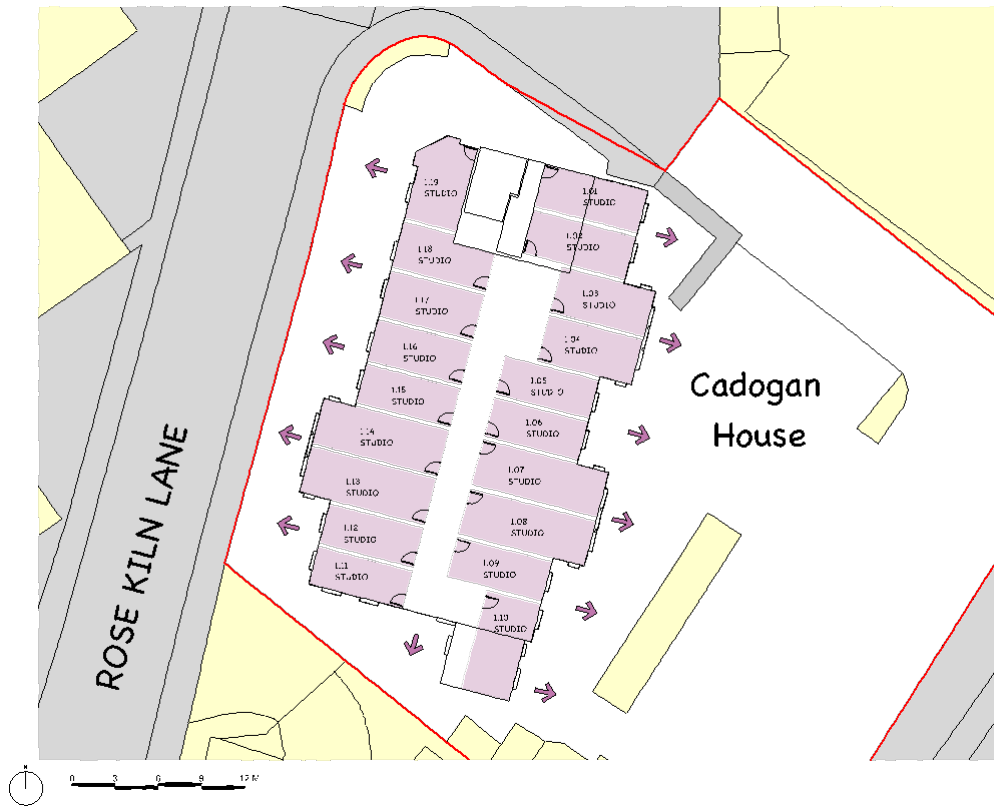


Figure 3-3: First floor proposed plans containing studio apartments



4 NOISE MEASUREMENTS

4.1 Noise Survey

4.1.1 Methodology

Due to lack of a secure location on site, unattended measurements for an extended period of time were not possible.

To gather noise levels incident on the site, attended measurements were undertaken in accordance with the CRTN shortened methodology (Calculation of Road Traffic Noise) [5].

This involved recording noise levels of 15-minute duration to the front and rear of the existing building over three consecutive hours between 10:00 hrs and 17:00 hrs for daytime measurements, and over 2 consecutive hours between 00:00 hrs and 02:00 hrs for night-time measurements. The attended measurement locations are shown in Figure 4.1 below. Noise levels were measured using a 01dB Duo sound level meter. The microphone was fitted with a weatherproof windshield and fixed to a tripod approximately 1.8 m above ground floor level.

The equipment was calibrated before and after the survey using a 01dB Cal 21 sound calibrator to generate a calibration level of 94.0 dB at 1 kHz. No significant calibration drifts were observed.

Figure 4.1: Site Location and Monitoring Positions



4.1.2 Weather Conditions

During the attended measurements, the weather conditions were observed to be dry with negligible wind. It is considered that the weather conditions did not adversely affect the noise measurements.

4.1.3 Results

Table 4.1 shows the results of the measurements carried out at the attended positions, for each measurement position, the $L_{A10,15min}$, and $L_{Aeq,15min}$ noise levels have been presented.

Table 4.1: Daytime Attended Survey Results

Ref	Position	Time	Duration mins	L_{Aeq} dB	L_{A10} dB	Dominant Source
A1	Rear façade	12:08	15	64	67	Road traffic noise on Rose Kiln Lane and A33
A2	Front façade	12:41	15	74	77	
A1	Rear façade	13:00	15	65	68	
A2	Front façade	13:27	15	74	78	
A1	Rear façade	14:00	15	64	67	
A2	Front façade	14:18	15	74	77	

The short-term measured noise levels have been used to extrapolate an $L_{Aeq,16hour}$ daytime noise level, based on guidance within the (CRTN) document, by which a shortened survey can be used to obtain an equivalent daytime L_{Aeq} .

CRTN states that measurements of L_{A10} should be made over any three consecutive hours between 10:00 hours and 17:00 hours. Using L_{A10} (3 hour) as the arithmetic mean of the three consecutive values of hourly L_{A10} , the value of L_{A10} (18 hour) can be calculated from the following relationship:

$$L_{A10} (18 \text{ hour}) = L_{A10} (3 \text{ hour}) - 1\text{dBA}$$

BS 8233:2014 [6] also describes the relationship between L_{A10} (18 hour) and L_{Aeq} (16 hour) for road traffic noise, as shown below:

$$L_{Aeq} (16 \text{ hour}) = L_{A10} (18 \text{ hour}) - 2\text{dBA}$$

Following the above guidance, the $L_{Aeq,16hour}$ at the measurement position are shown in Table 4.2 below.

Table 4.2: Daytime noise level calculated using CRTN method

Ref	Position	Daytime $L_{A10,18hr}$ dB (07:00 to 23:00 hrs)	Daytime $L_{Aeq,16hr}$ dB (07:00 to 23:00 hrs)
A1	Front façade	76	74
A2	Rear Façade	66	64

There is no shortened method for night-time assessments. However, it is accepted that the logarithmic average of measurements undertaken during the first or last 3 hours of the night provides a good approximation of the L_{Aeq} which occurs over the 8-hour night-time period. Typically, the noise levels at each end of the night-time

period are loudest. Therefore, this method provides a worst-case scenario. Accordingly, sample measurements were undertaken for representative sample periods within the first 3 hours of the night time period from 00:00 to 02:00 hours. The monitored noise levels are presented table 4.3.

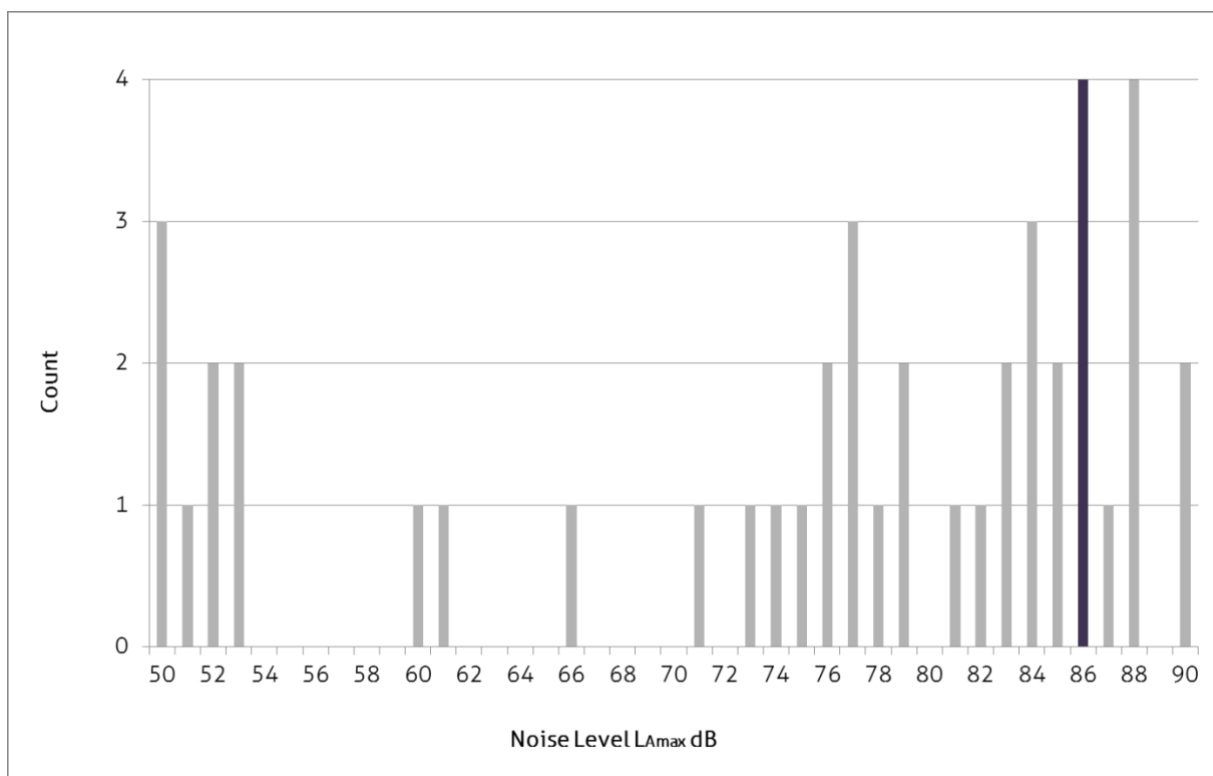
Table 4.3: Night Time Attended Survey Results

Ref	Position	Time	Duration mins	L _{Aeq} dB	Dominant Source
A1	Front façade	00:00	15	67	Road traffic noise on Rose Kiln Lane and A33
A2	Rear façade	00:16	15	58	
A1	Front façade	01:00	15	61	
A2	Rear façade	01:17	15	59	
A1	Front façade	02:00	15	70	

The results indicate average (façade) night-time ambient noise levels of 68 dB L_{Aeq} for the west facing façade and 59 dB L_{Aeq} for the east façade.

Figure 4.2 and 4.3 below present the frequency of maximum night-time noise events for the west and east facing façades. The data has been assessed using 1 minute data from the night time attended noise measurements.

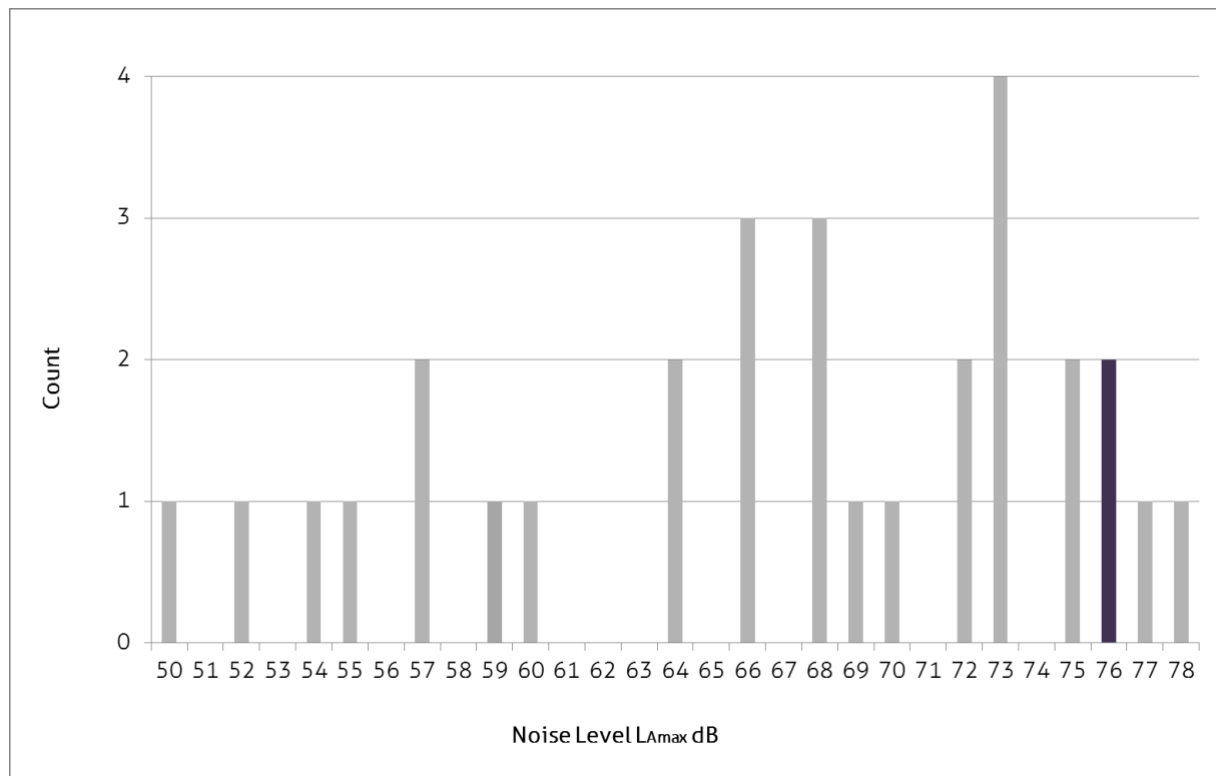
Figure 4.2: Distribution of L_{Amax} noise events for West facing façade



Regular high noise level events were measured incident on the west site boundary. As can be seen in Figure 4.2, maximum L_{Amax} events up to 90 dB occur and observations on site indicated that they were caused by road

vehicle pass-bys. It was also observed that a loose drain cover caused increased sound levels as vehicles passed on some occasions. In order to best represent typical noise events, and to avoid design to the 'worst case' events, the top portion of maximum events have been omitted from the façade calculations, this results in a level of 86 dB L_{Amax} highlighted above.

Figure 4.3: Distribution of L_{Amax} noise events for East facing façade



Again, for the east facade, the top portion of maximum events have been omitted from the façade calculations resulting in a level of 76 dB L_{Amax} highlighted above. The maximum levels were caused by vehicle pass-bys on A33 and can be seen to be lower than those at the west facade due to increased distance from the roadside.

4.2 Discussion

The results indicate that the front (west) of the property is exposed to levels of noise that would categorise the proposals as 'High Risk' as per ProPG guidance Stage 1. This results in the proposals requiring 'Good Acoustic Design' measures in order to achieve suitable internal noise conditions for rest and sleep. The following section sets out these measures based on the noise survey results.

The rear (east) façade is exposed to lower levels of noise due to screening from the main road by the building itself and distance from the A33. As a result, this would categorise the studio units to this façade as 'Medium Risk' as per ProPG guidance Stage 1. 'Good Acoustic Design' measures are still required in order provide suitable conditions and are also proposed in the following section.

5 GLAZING & VENTILATION RECOMMENDATIONS

As per Stage 2 of ProPG guidance, practical acoustic mitigation methods will need to be integrated within the proposals in order to provide suitable internal noise level conditions. In order to assess the requirements for window and ventilation it is necessary to estimate internal noise levels with windows closed using various glazing and ventilation products. It should be noted that there are no known outdoor amenity areas proposed in this development.

Calculations have been made in accordance with BS 8233:2014 and BS EN 12354-3:2000. The area of glazing and method of ventilation in any particular room, along with the room size and room acoustic conditions, affect the degree of reduction in noise transmission from outside to inside.

Calculations have been made based on proposed glazed areas and room dimensions as per 'PD_SITE PLAN' & 'PD_1F PLAN' dated 20th July 2018, provided by RRA Architects. Calculations should be refined if proposals are altered during later design stages.

A full list of calculation assumptions is shown in Appendix B. Full spectral calculations are provided in Appendix B.

Details of the recommended performance requirements of the windows and ventilators are given in Table 5.1 and 5.2 for west and east facing rooms respectively, along with indicative specifications.

Table 5.1: Glazing and ventilation performance requirements – West facing

Room	Performance Requirements				Comments
	Window Units		Ventilators		
West facing rooms	R _w	R _w + C _{tr}	D _{n,e,w}	D _{n,e,w} + C _{tr}	
Studio (Single, dual or triple aspect units)*	46	39	46	43	A double glazing unit such as SG Phonip 9/20/11mm glazing with laminate and an acoustic passive ventilator with the specified performance should provide the minimum performance requirements.

*Note: The recommended glazing and ventilation specification for studios have been selected based on the maximum noise levels at night time which were the controlling factor in the façade design.

Table 5.2: Glazing and ventilation performance requirements – East facing

Room	Performance Requirements				Comments
	Window Units		Ventilators		
East facing rooms	R _w	R _w + C _{tr}	D _{n,e,w}	D _{n,e,w} + C _{tr}	
Studio (Single or dual aspect units)*	33	29	37	35	A standard double glazing unit such as 4/12/6mm and an acoustic trickle ventilator with the specified performance should provide the minimum performance requirements.

*Note: The recommended glazing and ventilation specification for studios have been selected based on the maximum noise levels at night time which were the controlling factor in the façade design.

All glazing systems and ventilators proposed should be capable of meeting the performance specifications detailed above, with test certificates being made available in support. Glazing proposals which only reflect the guidance constructions indicated in this report will not be sufficient evidence that a glazing system will achieve the required performance specification.

6 CONCLUSIONS

A noise assessment has been undertaken to assess the impact of noise on the proposed development at Cadogan House, Rose Kiln Lane, Reading RG2 0HP. Site observations indicated that the noise climate around the building was dominated by local traffic on Rose Kiln Lane and the A33.

Noise measurements were undertaken on the site to establish the level of ambient noise incident on the proposed development and results are presented as per Stage 1 of ProPG. It was concluded that the site shall be categorised as “High Risk” to the west façade and “Medium Risk” to the east façade and therefore acoustic mitigation measures are needed to be integrated within the design to achieve suitable internal ambient noise levels.

Using the noise data captured, advice has been given on the design of the building envelope to ensure that internal noise levels inside habitable rooms lie within guideline limits, as recommended in WHO and BS8233:2014, which are in line with Stage 2 ProPG recommendations.

The required sound insulation performances can be met with acoustic laminate glazing and acoustic trickle ventilators. With these measures in place recommended internal noise levels set out in WHO and BS8233 should be met, and conditions for occupants should equate to No Observed Adverse Effect and therefore in our opinion Reading Borough Council’s Planning Policy CS34 shall be satisfied.

With the above measures in place the change from commercial to residential use will not be an issue in terms of noise ingress from external sources.

7 REFERENCES

- 1 Noise Policy Statement for England (NPSE). 15 March 2010
- 2 National Planning Policy Framework (NPPF). 27 March 2012. Updated 24 July 2018.
- 3 Reading Borough Council Adopted Core Strategy Document. January 2018, revised January 2015.
- 4 Draft Reading Borough Local Plan. May 2017.
- 5 Institute of Acoustics (IOA), Association of Noise Consultants (ANC) and Chartered Institute of Environmental Health (CIEH). Professional Planning Guidance on Planning & Noise (ProPG): New Residential Development. May 2017.
- 6 British Standards Institution. Sound Insulation and Noise Reduction for Buildings – Code of Practice. BS 8233: 2014
- 7 World Health Organisation - Guidelines for Community Noise. 2000
- 8 Department of Transport Welsh Office. Calculation of Road Traffic Noise. 1988

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APPENDIX A

FAÇADE NOISE INGRESS CALCULATIONS AND ASSUMPTIONS

The following assumptions have been used for the assessment of the sound insulation requirements of the building envelope:

- › Sound insulation data has been based on both library data and specific manufacturers' data. It has been assumed that the on-site performance will be comparable with manufacturer's claimed performance.
- › The predictions assume good quality workmanship, for example that windows, doors and opening lights are well sealed. Poor workmanship or low quality seals may result in predicted internal noise levels being exceeded.
- › External walls are understood to be of cavity masonry construction with mineral fibre in the cavity.
- › It is understood that the proposed ventilation strategy is for natural ventilation in habitable rooms. The number of ventilators has a substantial influence on the sound insulation of the building envelope. Current guidance on complying with the Building Regulations (Approved Document F) offers many options to provide adequate ventilation. Some of these are more preferable with regards to noise break-in, such as whole house ventilation with heat recovers as no through wall vents are required. Other options require anywhere between 1 and 6 ventilators per room. It has been assumed that there will be 2 no. ventilators in living rooms and 1 no in bedrooms.
- › Room dimensions and glazing areas are based on the proposed plans as per Figures 3.2 and 3.3 in this report, 'PD_SITE PLAN' & 'PD_1F PLAN' dated 20th July 2018 by RRA Architects, where typical and worst case units have been assessed.

Room layout assumptions

Dimension	Studio (west)	Studio (west) triple aspect	Studio (east)	Studio (east) dual aspect
Volume (m ³)	49	49	49	59
Glazing Area (m ²)	3	13	3	4
External wall area (m ²)	9	20	9	24
No. ventilators	2	2	2	2

The sound insulation requirements of the glazing are applicable to the window system as a whole, including frames, mullions and panels. They are based on BS EN ISO 140-3: 1995 "*Laboratory measurement of airborne sound insulation of building elements and rated in accordance with BS EN ISO 717-1:2013 Acoustics – Rating of sound insulation in buildings and of building elements Part 1. Airborne sound insulation*".

For unit ventilators, the measurements are based on BS EN ISO 140-10: 1995 Laboratory measurement of airborne sound insulation of small building elements and rated in accordance with BS EN ISO 717-1:1997 "*Acoustics – Rating of sound insulation in buildings and of building elements Part 1. Airborne sound insulation*".

Table B1: Studio Daytime (West façade overlooking Rose Kiln Lane) – L_{eq}

Job name:

Cadogan House, Reading

Job no.:

3149

Façade:

Front Studio (West) Daytime

RESULT SUMMARY:

Predicted Internal Level:

32

dB L_{Aeq, T}

Criterion:

35

dB L_{Aeq, T}

Difference:

-3

dB L_{Aeq, T}

SOUND INSULATION BY ELEMENT

Formula

Description

Data

Units

Octave band centre frequency, Hz

125

250

500

1000

2000

4000

dB(A)

Reverberation Time

s

0.5

0.5

0.5

0.5

0.5

0.5

Receiver Room Volume

48.6

m³

Element 1

Wall (database)

</

Table B2: Studio Night time (West façade) – L_{Amax}

Job name: Cadogan House, Reading
Job no.: 3149
Façade: Front Studio (West) Night-time Max

RESULT SUMMARY:

Predicted Internal Level: **43** dB L_{Amax}
 Criterion: **45** dB L_{Amax}
 Difference: **-2** dB L_{Amax}

SOUND INSULATION BY ELEMENT

Formula	Description	Data	Units	Octave band centre frequency, Hz						dB(A)
				125	250	500	1000	2000	4000	
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5	
	Receiver Room Volume	48.6	m ³							
Element 1										
	Wall (database)									
L1	Façade	Lmax		74	79	81	84	81	70	86
-R	Brick-block cavity wall			41	45	45	54	58	58	52 Rw
+10logS	Element Area	9.45	m ²	10	10	10	10	10	10	48 Rw+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				30	32	33	28	21	10	33
L2tot	Running total			30	32	33	28	21	10	33
Element 2										
	Window (database)									
L1	Façade	Lmax		74	79	81	84	81	70	86
-R	SG Phonip 9/20/11 SG Phonip			27	37	44	51	50	53	46 Rw
+10logS	Element Area	3	m ²	5	5	5	5	5	5	39 Rw+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				39	35	29	26	24	10	33
L2tot	Running total			40	36	35	30	26	13	36
Element 3										
	Ventilator (database)									
L1	Façade	Lmax		74	79	81	84	81	70	86
-R	Renson AK43 - Acoustic trickle vent			34	40	44	46	48	52	46 Dnew
+10logSo	Reference Area	20	m ²	13	13	13	13	13	13	43 Dnew+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				40	39	38	40	34	20	42
L2tot	Running total			43	41	40	40	35	20	43

Table B3: Studio Triple Aspect Daytime (West façade) – L_{eq}

Job name: Cadogan House, Reading
Job no.: 3149
Façade: Front Studio Triple Aspect (West) Daytime

RESULT SUMMARY:

Predicted Internal Level: **34** $\text{dB } L_{A \text{ eq, T}}$
 Criterion: **35** $\text{dB } L_{A \text{ eq, T}}$
 Difference: **-1** $\text{dB } L_{A \text{ eq, T}}$

SOUND INSULATION BY ELEMENT

Formula	Description	Data	Units	Octave band centre frequency, Hz						
				125	250	500	1000	2000	4000	dB(A)
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5	
	Receiver Room Volume	48.6	m^3							
Element 1	Wall (database)									
L1	Façade		Leq	67	68	68	73	70	64	76
-R	Brick-block cavity wall			41	45	45	54	58	58	52 Rw
+10logS	Element Area	19.8	m^2	13	13	13	13	13	13	48 Rw+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				27	24	24	20	13	8	25
L2tot	Running total			27	24	24	20	13	8	25
Element 2	Window (database)									
L1	Façade		Leq	67	68	68	73	70	64	76
-R	SG Phonip 9/20/11 SG Phonip			27	37	44	51	50	53	46 Rw
+10logS	Element Area	12.6	m^2	11	11	11	11	11	11	40 Rw+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				39	30	23	21	19	11	28
L2tot	Running total			39	31	27	24	20	12	30
Element 3	Ventilator (database)									
L1	Façade		Leq	67	68	68	73	70	64	76
-R	Renson AK43 - Acoustic trickle vent			34	40	44	46	48	52	46 Dnew
+10logSo	Reference Area	20	m^2	13	13	13	13	13	13	43 Dnew+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				33	28	25	29	23	14	31
L2tot	Running total			40	33	29	30	25	16	34

Table B4: Studio Triple Aspect Night time (West façade) – L_{Amax}

Job name: Cadogan House, Reading		RESULT SUMMARY:								
Job no.: 3149		Predicted Internal Level: 45 dB L_{A max}								
Façade: Front Studio Triple Aspect (West) Night-time Max		Criterion: 45 dB L_{A max}								
		Difference: 0 dB L_{A max}								
SOUND INSULATION BY ELEMENT										
Formula	Description	Data	Units	Octave band centre frequency, Hz						dB(A)
				125	250	500	1000	2000	4000	
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5	
	Receiver Room Volume	48.6	m ³							
Element 1										
	Wall (database)									
L1	Façade	Lmax		74	79	81	84	81	70	86
-R	Brick-block cavity wall			41	45	45	54	58	58	52 Rw
+10logS	Element Area	19.8	m ²	13	13	13	13	13	13	48 Rw+Ctr
-10logA	where A=0.16V/T			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				34	35	37	31	24	13	36
L2tot	Running total			34	35	37	31	24	13	36
Element 2										
	Window (database)									
L1	Façade	Lmax		74	79	81	84	81	70	86
-R	SG Phonip 9/20/11 SG Phonip			27	37	44	51	50	53	46 Rw
+10logS	Element Area	12.6	m ²	11	11	11	11	11	11	39 Rw+Ctr
-10logA	where A=0.16V/T			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				46	41	36	32	30	16	39
L2tot	Running total			46	42	39	35	31	18	41
Element 3										
	Ventilator (database)									
L1	Façade	Lmax		74	79	81	84	81	70	86
-R	Renson AK43 - Acoustic trickle vent			34	40	44	46	48	52	46 Dnew
+10logSo	Reference Area	20	m ²	13	13	13	13	13	13	43 Dnew+Ctr
-10logA	where A=0.16V/T			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				40	39	38	40	34	20	42
L2tot	Running total			47	44	42	41	36	22	45

Table B5: Studio Daytime (East façade) – L_{eq}

Job name: Cadogan House, Reading
Job no.: 3149
Façade: Rear Studio (East) Daytime

RESULT SUMMARY:

Predicted Internal Level: **32** **dB $L_{A,eq,T}$**
 Criterion: **35** **dB $L_{A,eq,T}$**
 Difference: **-3** **dB $L_{A,eq,T}$**

SOUND INSULATION BY ELEMENT

Formula	Description	Data	Units	Octave band centre frequency, Hz						dB(A)
				125	250	500	1000	2000	4000	
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5	
	Receiver Room Volume	48.6	m ³							
Element 1										
	Wall (database)									
L1	Façade		Leq	62	60	60	64	59	51	66
-R	Brick-block cavity wall			41	45	45	54	58	58	52 Rw
+10logS	Element Area	9.45	m ²	10	10	10	10	10	10	48 Rw+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				19	13	12	8	-1	-9	13
L2tot	Running total			19	13	12	8	-1	-9	13
Element 2										
	Window (database)									
L1	Façade		Leq	62	60	60	64	59	51	66
-R	SGG 4/12/6mm			23	22	27	38	40	41	33 Rw
+10logS	Element Area	3	m ²	5	5	5	5	5	5	29 Rw+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				32	31	25	19	12	3	27
L2tot	Running total			32	31	26	19	12	3	27
Element 3										
	Ventilator (database)									
L1	Façade		Leq	62	60	60	64	59	51	66
-R	Renson AK35 - Acoustic trickle vent			29	30	37	39	36	42	37 Dnew
+10logSo	Reference Area	20	m ²	13	13	13	13	13	13	35 Dnew+Ctr
-10logA	where $A=0.16V/T$			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				34	32	24	26	24	11	31
L2tot	Running total			36	34	28	27	24	12	32

Table B6: Studio Night-time (East façade) – L_{Amax}

Job name: Cadogan House, Reading
Job no.: 3149
Façade: Rear Studio (East) Night-time Max

RESULT SUMMARY:

Predicted Internal Level: **44** dB L_{Amax}
 Criterion: **45** dB L_{Amax}
 Difference: **-1** dB L_{Amax}

SOUND INSULATION BY ELEMENT

Formula	Description	Data	Units	Octave band centre frequency, Hz						dB(A)
				125	250	500	1000	2000	4000	
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5	
	Receiver Room Volume	48.6	m ³							
Element 1										
L1	Wall (database)									
	Façade	Lmax		72	73	73	75	67	63	76
-R	Brick-block cavity wall			41	45	45	54	58	58	52 Rw
+10logS	Element Area	9.45	m ²	10	10	10	10	10	10	48 Rw+Ctr
-10logA	where A=0.16V/T			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				29	26	26	18	7	3	26
L2tot	Running total			29	26	26	18	7	3	26
Element 2										
L1	Window (database)									
	Façade	Lmax		72	73	73	75	67	63	76
-R	SGG 4/12/6mm			23	22	27	38	40	41	33 Rw
+10logS	Element Area	3	m ²	5	5	5	5	5	5	29 Rw+Ctr
-10logA	where A=0.16V/T			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				42	44	39	29	20	15	40
L2tot	Running total			42	44	40	30	20	15	40
Element 3										
L1	Ventilator (database)									
	Façade	Lmax		72	73	73	75	67	63	76
-R	Renson AK35 - Acoustic trickle vent			29	30	37	39	36	42	37 Dnew
+10logSo	Reference Area	20	m ²	13	13	13	13	13	13	35 Dnew+Ctr
-10logA	where A=0.16V/T			12	12	12	12	12	12	
+0		0		0	0	0	0	0	0	
=L2				44	45	38	37	33	22	42
L2tot	Running total			46	48	42	38	33	23	44

Table B7: Studio Dual Aspect Daytime (East façade) – L_{eq}

Job name: Cadogan House, Reading		RESULT SUMMARY:								
Job no.: 3149		Predicted Internal Level: 32 dB L_A eq, T								
Façade: Rear Studio Dual Aspect (East) Daytime		Criterion: 35 dB L_A eq, T								
		Difference: -3 dB L_A eq, T								
SOUND INSULATION BY ELEMENT										
Formula	Description	Data	Units	Octave band centre frequency, Hz						dB(A)
				125	250	500	1000	2000	4000	
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5	
	Receiver Room Volume	59.4	m ³							
Element 1										
L1	Wall (database)			62	60	60	64	59	51	66
-R	Façade	Leq		41	45	45	54	58	58	52 Rw
+10logS	Brick-block cavity wall			14	14	14	14	14	14	48 Rw+Ctr
-10logA	Element Area	24.15	m ²	13	13	13	13	13	13	
+0	where A=0.16V/T			0	0	0	0	0	0	
=L2		0		22	16	16	11	2	-6	16
L2tot	Running total			22	16	16	11	2	-6	16
Element 2										
L1	Window (database)			62	60	60	64	59	51	66
-R	Façade	Leq		23	22	27	38	40	41	33 Rw
+10logS	SGG 4/12/6mm			6	6	6	6	6	6	29 Rw+Ctr
-10logA	Element Area	4.2	m ²	13	13	13	13	13	13	
+0	where A=0.16V/T			0	0	0	0	0	0	
=L2		0		33	31	26	19	12	4	27
L2tot	Running total			33	32	26	20	13	4	28
Element 3										
L1	Ventilator (database)			62	60	60	64	59	51	66
-R	Façade	Leq		29	30	37	39	36	42	37 Dnew
+10logSo	Renson AK35 - Acoustic trickle vent			13	13	13	13	13	13	35 Dnew+Ctr
-10logA	Reference Area	20	m ²	13	13	13	13	13	13	
+0	where A=0.16V/T			0	0	0	0	0	0	
=L2		0		34	31	23	25	23	10	30
L2tot	Running total			36	34	28	26	24	11	32

Table B8: Studio Dual Aspect Night-time (East façade) – L_{Amax}

Job name: Cadogan House, Reading
Job no.: 3149
Façade: Rear Studio Dual Aspect (East) Night-time Max

RESULT SUMMARY:

Predicted Internal Level: **44** dB L_{Amax}
 Criterion: **45** dB L_{Amax}
 Difference: **-1** dB L_{Amax}

SOUND INSULATION BY ELEMENT

Formula	Description	Data	Units	Octave band centre frequency, Hz						dB(A)		
				125	250	500	1000	2000	4000			
	Reverberation Time		s	0.5	0.5	0.5	0.5	0.5	0.5			
	Receiver Room Volume	59.4	m ³									
Element 1												
	Wall (database)											
L1	Façade		Lmax	72	73	73	75	67	63	76		
-R	Brick-block cavity wall			41	45	45	54	58	58	52	Rw	48 Rw+Ctr
+10logS	Element Area	24.15	m ²	14	14	14	14	14	14			
-10logA	where A=0.16V/T			13	13	13	13	13	13			
+0		0		0	0	0	0	0	0			
=L2				32	29	29	22	10	6	29		
L2tot	Running total			32	29	29	22	10	6	29		
Element 2												
	Window (database)											
L1	Façade		Lmax	72	73	73	75	67	63	76		
-R	SGG 4/12/6mm			23	22	27	38	40	41	33	Rw	29 Rw+Ctr
+10logS	Element Area	4.2	m ²	6	6	6	6	6	6			
-10logA	where A=0.16V/T			13	13	13	13	13	13			
+0		0		0	0	0	0	0	0			
=L2				42	45	40	30	21	15	40		
L2tot	Running total			43	45	40	31	21	16	41		
Element 3												
	Ventilator (database)											
L1	Façade		Lmax	72	73	73	75	67	63	76		
-R	Renson AK35 - Acoustic trickle vent			29	30	37	39	36	42	37	Dnew	35 Dnew+Ctr
+10logSo	Reference Area	20	m ²	13	13	13	13	13	13			
-10logA	where A=0.16V/T			13	13	13	13	13	13			
+0		0		0	0	0	0	0	0			
=L2				43	44	37	36	32	21	41		
L2tot	Running total			46	48	42	37	32	23	44		