NOISE IMPACT ASSESSMENT

Gidar House, 13 The Crossway, Uxbridge, Hillingdon, Greater London, UB10 0JH

23rd June 2022

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Email: enquiries@daagroup.co.uk Tel: 0207 101 9669 Mobile: 07957 553188 Company Registration No. 0249971

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Author	Date	Checked	Date	Description
L. Jennings Tec. IOA	20/02/2022	M.Austin I.Eng. MIOA	23/02/2022	Information.
L. Jennings Tec. IOA	23/06/2022	M.Austin I.Eng. MIOA	23/06/2022	Update

1.0 INTRODUCTION

DAA Group has been appointed to carry out a Noise Impact Assessment at Gidar House, 13 The Crossway, Uxbridge, Hillingdon, Greater London, UB10 0JH to support a Prior Approval Application for a proposed change of use to residential units in accordance with the Permitted Development legislation requirement allowing Local Planning Authorities to consider potential impacts of noise specifically from commercial premises on intended occupiers of residential developments.

Under Permitted Development legislation there is no requirement to consider noise from transport infrastructure type sources such as road traffic. Notwithstanding this, assessment of noise to the proposed change of use residential development in this report unavoidably includes noise from road traffic as being the principle and dominant source. This is provided as good practice, for completeness and as informative to the developer, rather than as being required by Permitted Development legislation.

Using results of the noise survey, the sound insulation performance for the whole building envelope including glazing (windows) is assessed, and a scheme of noise mitigation measures is established and included in the report verified by BS8233:2014 rigorous method building envelope sound insulation calculations.

A scheme of noise mitigation measures in the report provides specification details as appropriate for sound insulation upgrade treatment to the separating walls and separating floors.

The technical content of this assessment has been provided by a Tech member of the Institute of Acoustics.

The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration

2.0 NOISE CRITERIA

2.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

The Department for Communities and Local Government introduced the National Planning Policy Framework (NPPF) in March 2012. The latest revision of the NPPF is dated July 2021.

The NPPF sets out the Government's planning policies for England and how these are expected to be applied. It provides a framework where local Councils can produce their own local and neighbourhood plans which reflect the needs of their communities.

In conserving and enhancing the natural environment, the planning system should prevent both new and existing development from contributing to, or being put at, unacceptable risk from environmental factors including noise.

Planning policies and decisions should aim to avoid noise giving rise to significant adverse impacts on health and quality of life as a result of new development. Conditions may be used to mitigate and reduce noise to a minimum so that adverse impacts on health and quality of life are minimised. It must be recognised that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them. Reference is made within NPPF to the Noise Policy Statement for England (NPSE) as published by DEFRA in March 2021.

2.2 NOISE POLICY STATEMENT FOR ENGLAND (NPSE)

The long-term vision of the NPSE is stated within the documents scope, to 'promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development'. The policy aims are stated to:

- 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 application of NPSE should mean that noise is properly taken into account at the appropriate time (for example in planning applications or appeals) where it must be considered alongside other relevant issues. The guiding principles of Government policy on sustainable development should be used to assist in the implementation of the NPSE.

The NPSE should apply to all types of noise apart from occupational noise in the workplace. The types of noises defined in the NPSE includes:

- Environmental noise from transportation sources;
- Neighbourhood noise which includes noise arising from within the community; industrial premises, trade and business premises, construction sites and noise in the street

The Noise Policy Statement England (NPSE) outlines observed effect levels relating to the above, as follows:

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

As stated in The Noise Policy Statement England (NPSE), it is not currently possible to have a single objective based measure that defines SOAEL that is applicable to all sources of noise in all situations. Specific noise levels are not stated within the guidance for this reason, and allow flexibility in the policy until further guidance is available.

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2.3 ProPG: PLANNING AND NOISE

As outlined above, the National Planning Policy Framework encourages improved standards of design, although it provides no specific noise levels which should be achieved on site for varying standards of acoustic acceptability, or a prescriptive method for the assessment of noise.

ProPG: Planning and Noise was published in May 2017 in order to encourage better acoustic design for new residential schemes in order to protect future residents from the harmful effects of noise. This guidance can be seen as the missing link between the current NPPF and its predecessor, PPG24 (Planning Policy Guidance 24: Planning and Noise), which provided a prescriptive method for assessing sites for residential development, but without the nuance of 'good acoustic design' as outlined in ProPG.

ProPG allows the assessor to take a holistic approach to consider the site's suitability, taking into consideration numerous design factors which previously may not have been considered alongside the noise level measured on site, for example the orientation of the building in relation to the main source of noise incident upon it.

It should be noted this document is not an official government code of practice, and neither replaces nor provides an authoritative interpretation of the law or government policy, and therefore should be seen as a good practice document only.

2.4 ACOUSTICS VENTILATION AND OVERHEATING

The AVO Guide includes:

- an explanation of ventilation requirements under the building regulations and as described in Approved Document F, along with typical ventilation strategies and associated noise considerations;
- an explanation of the overheating assessment methodology described in CIBSE TM59; potential acoustic criteria and guidance relating to different ventilation and overheating conditions, for both environmental noise ingress and building services noise;
- and a worked example of the application of the AVO Guide including indicative design solutions.

The AVO Guide is intended for the consideration of new residential development that will be exposed predominantly to airborne sound from transport sources, and to sound from mechanical services that are serving the dwellings in question. Although the policy coverage is limited to England, the approach may be applicable in other parts of the UK.

The AVO Guide is intended to contribute to the practice of good acoustic design, as emphasised in the Professional Practice Guidance on Planning and Noise (ProPG). In particular

2.5 BRITISH STANDARD BS 8233:2014

British Standard Code of Practice BS8233:2014 'Sound insulation and noise reduction for buildings' provides recommended guideline value for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation Guidelines for Community Noise 1999 (WHO).

Activity	Location	07:00 to23:00	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 $L_{Aeq,8hour}$

2.4.1 Indoor ambient noise levels for dwellings

The WHO guideline noise criteria set an internal sleep disturbance noise limit of 45dB LAmax,F which should not be exceeded on a regular basis.

2.6 THE LONDON PLAN (2021)

The New London Plan was formally published on the 2nd of March 2021 and replaces the previous London Plan.

The London Place notes that noise is an integral part of development planning. When designing developments, it notes that "measures to design out exposure to poor air quality and noise from both external and internal sources should be integral to development proposals and be considered early in the design process.

Characteristics that increase pollutant or noise levels, such as poorly-located emission sources, street canyons and noise sources should also be designed out wherever possible. Optimising site layout and building design can also reduce the risk of overheating as well as minimising carbon emissions by reducing energy demand" (para 3.3.9).

Policy D13 Agent of Change formalises the Agent of Change principle in London's planning policy in relation to noise. The policy notes:

"For a long time, the responsibility for managing and mitigating the impact of noise and other nuisances on neighbouring residents and businesses has been placed on the business or activity making the noise or other nuisance, regardless of how long the business or activity has been operating in the area. In many cases, this has led to newly-arrived residents complaining about noise and other nuisances from existing businesses or activities, sometimes forcing the businesses or other activities to close" (para 3.13.1).

"The Agent of Change principle places the responsibility for mitigating the impact of noise and other nuisances firmly on the new development. This means that where new developments are proposed close to existing noise-generating uses, for example, applicants will need to design them in a more sensitive way to protect the new occupiers, such as residents, businesses, schools and religious institutions, from noise and other impacts.

This could include paying for soundproofing for an existing use, such as a music venue. The Agent of Change principle works both ways. For example, if a new noise-generating use is proposed close to existing noisesensitive uses, such as residential development or businesses, the onus is on the new use to ensure its building or activity is designed to protect existing users or residents from noise impacts" (para 3.13.2).

Policy D13 states:

A. "The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance-gene rating uses in a sensitive manner when new development is proposed nearby.

B. Development should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.

C. New noise and other nuisance-generating development proposed close to residential and other noisesensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.

D. Development proposals should manage noise and other potential nuisances by:
   1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area
   2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations
   3) separating new noise-sensitive development where possible from existing noisegenerating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.

E. Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed".

Policy D14 Noise goes on to state:

F. "In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by: 1) avoiding significant adverse noise impacts on health and quality of life
   2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change 3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses
   4) improving and enhancing the acoustic environment and promoting appropriate soundscapes
   (including Quiet Areas and spaces of relative tranquillity)
   5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation
   6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any

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potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

G. Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations".

Policy D14 notes that "the management of noise should be an integral part of development proposals and considered as early as possible" (para 3.14.1)

It notes that "The management of noise also includes promoting good acoustic design of the inside of buildings.

Section 5 of BS 8223:2014 provides guidance on how best to achieve this. The Institute of Acoustics has produced advice, Pro:PG Planning and Noise (May 2017), that may assist with the implementation of residential developments. BS4214 provides guidance on monitoring noise issues in mixed residential/industrial areas" (para 3.14.3).

3.0 SITE SURVEYS 3.1 SITE DESCRIPTION

The site for the proposal is situated within a largely residential area to the North of Hillingdon Hill/ Uxbridge Road. 13 The Crossway is a currently vacant office block on the East side of the road, set behind a parade of shops with residential units above and next to a semi-detached property. Page | 9 The site lies within the Hillingdon Village Conservation Area. (See Figure 3.1)

Figure 3.1 – Proposed Site

3.2 ENVIRONMENTAL SITE SURVEY PROCEDURE

Measurements were carried out 1m outside a second-floor window (See figure 3.2) and logged over a 24hr period between the 14th and 15th February 2022.
The measurements were taken to establish the ambient sound level at the site, with respect to criteria of BS8233:2014.

The weather was suitable conditions to carry out the noise survey.

Figure 3.2 – Measurement Location

3.3 EQUIPMENT

Instrument manufacturer	**Cirrus Research Plc**
Model	**IEC 61672-3:2013**
Serial Number	**G302987**
Microphone Type	**MK:224**
Serial Number	**214457A**
Cirrus CK: 675 Outdoor Kit	
Type 1 Acoustic Calibrator	

The calibration of the sound level meters was verified in-situ before any measurements were taken, using the hand held calibrator and reference tone of 114dB at 1kHz. Validation checks at the end of the survey indicated that all instruments had operated within permitted tolerances for drift and measured level.

Copies of Calibration certificates are available upon request.

4.0 NOISE SURVEY

The following free-field sound levels have been derived for assessment of environmental noise break-in. It shall be noted that the data is 3dB below the information in Appendix A to equate from façade to free-field conditions.

A maximum value is provided for each night-time measurement period. Based on the World Health Organisation interpretation that for a noise to be regular it needs to occur several (i.e. more than two) times per hour; the LAmax(f) noise needs to be based upon an average of 10-15 events that are typical in nature. The aim of protecting against maximum noise levels is to ensure protection against typical intermittent noise levels rather than one-off events; whereby an arithmetic average of the 15 typical maximum events across each night period is used to determine values of dB LAmax(f) reported below. These have been summarised in table 4.1 below.

Measurement Data	Free Field Sound Pressure Level dB Gidar House	
Time	Average $L_{Aeq,T}$	Maximum $L_{AMAX,(f)}$
07:00 – 23:00	62dB	73dB
23:00 – 07:00	55dB	71dB

Table 4.1 - Measurement Levels

Leq, ff noise levels are taken as the continuous equivalent free-field sound pressure level outside the room elements under consideration. These correspond to the highest reliable readings taken for day and night periods.

Location	T	Time	Free-Field Sound Pressure Level Leq, T dB re.20µPa						
			125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	A
Gidar House	16h	Day	67	61	60	58	53	45	62
	8h	Night	60	54	53	51	46	39	55
		Max	76	70	69	67	62	54	71

Table 4.2 Summary of Highest octave -band sound levels for break in assessment

5.0 PROPOSED RESIDENTIAL UNITS – LAYOUT DESIGN

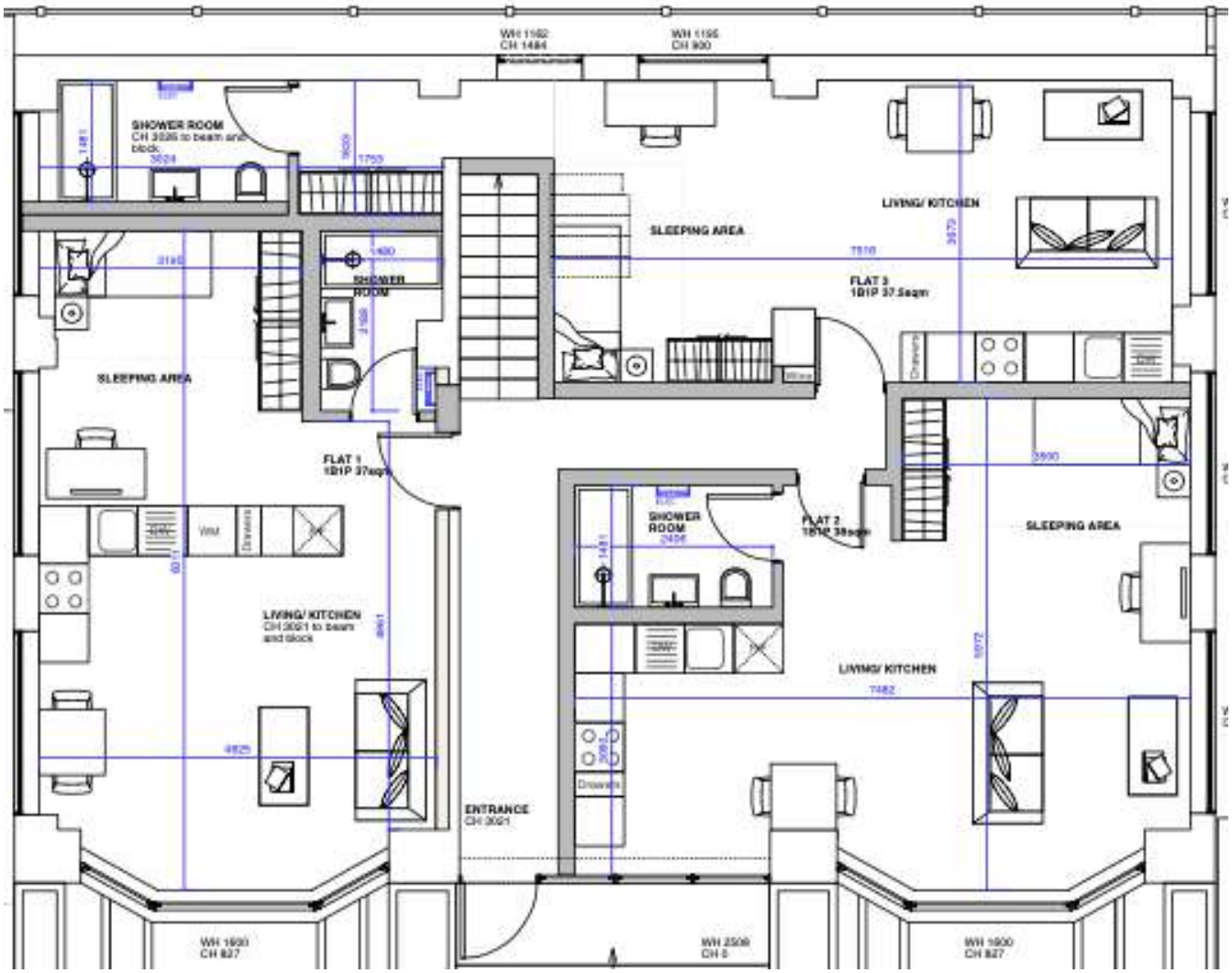

Figure 5.0 - Architectural Drawings of Proposed Ground Floor

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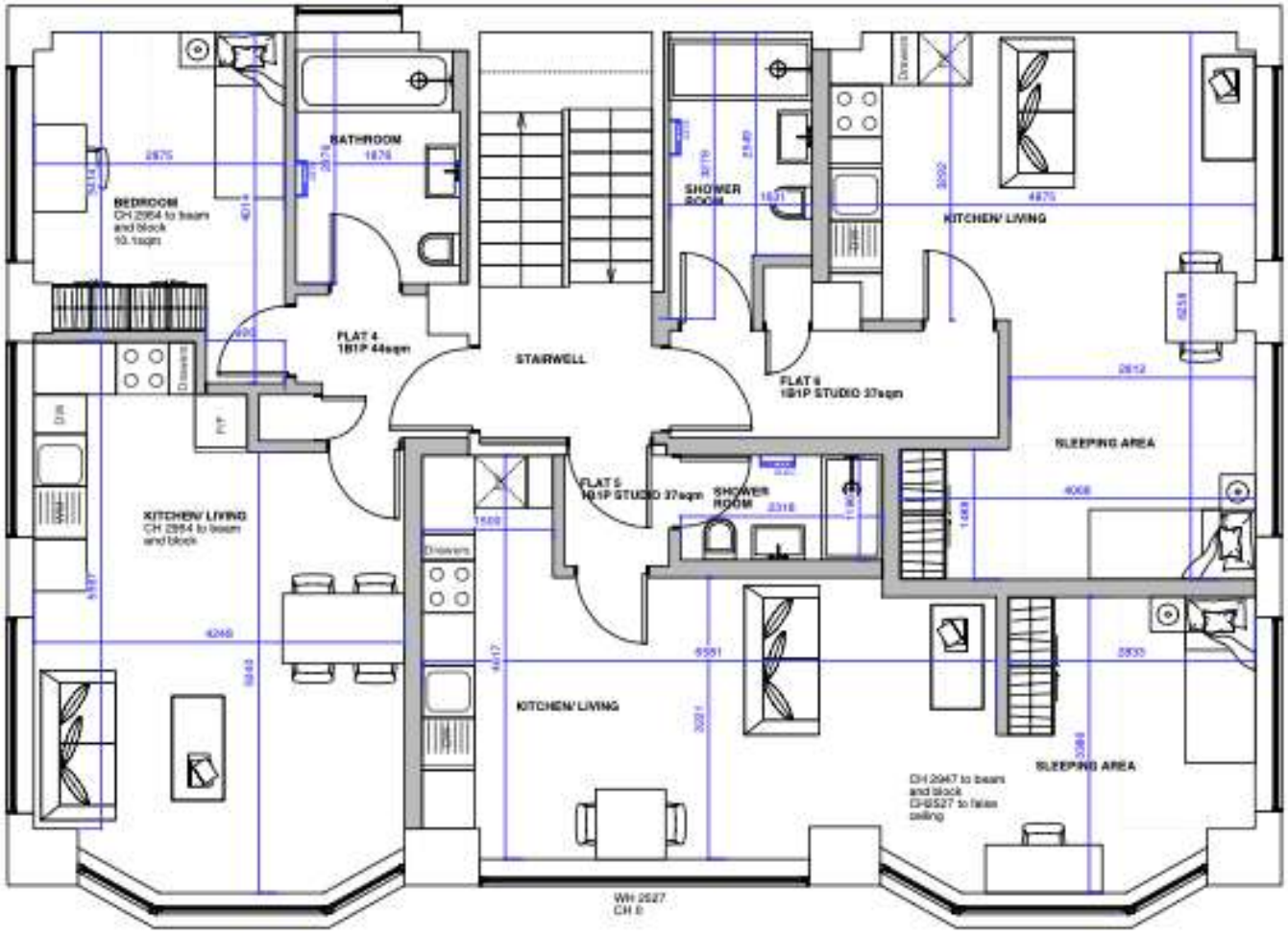

Figure 5.0.1 - Architectural Drawings of Proposed First Floor

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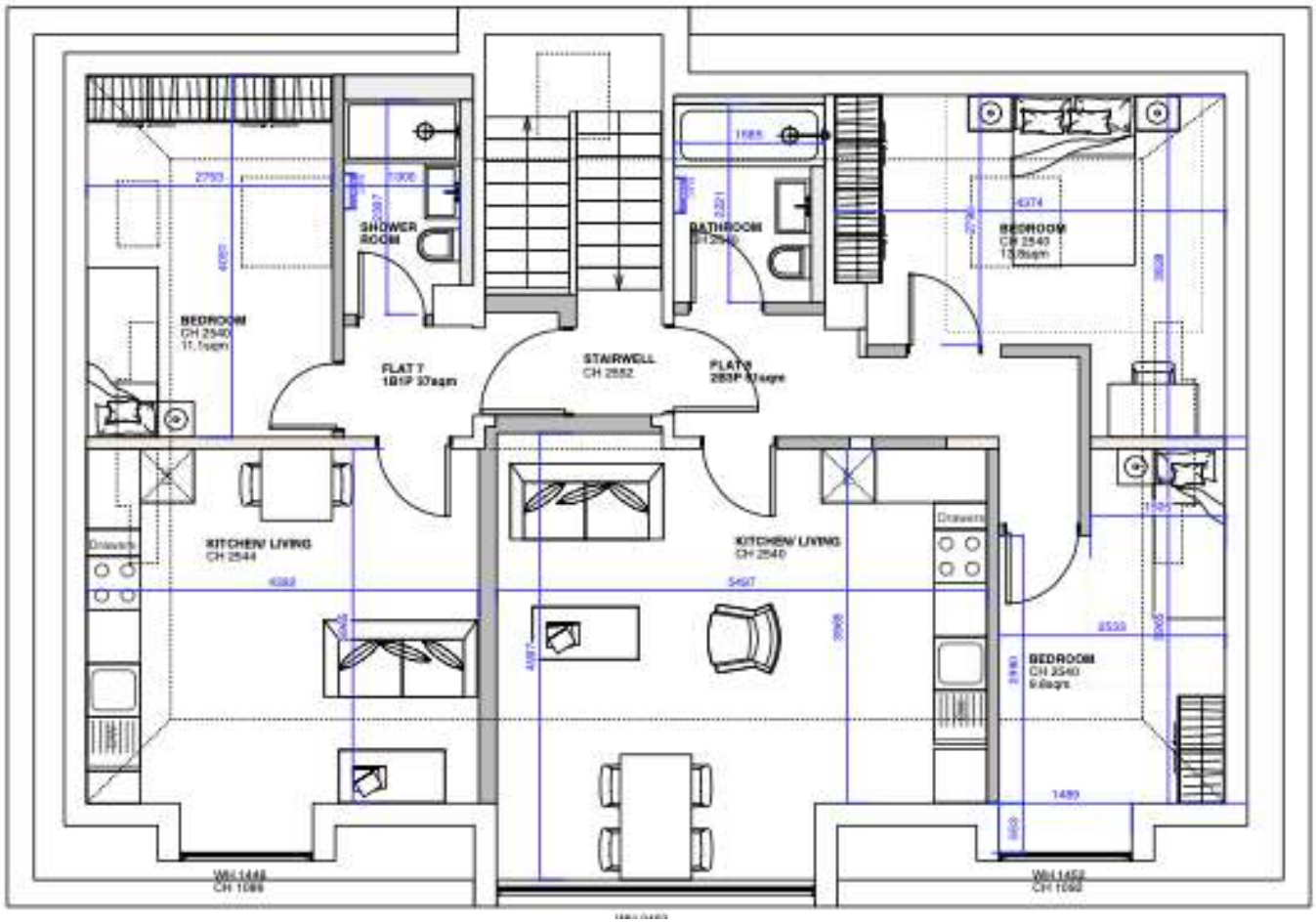


Figure 5.0.2 - Architectural Drawings of Proposed Second Floor

5.1 EXTERNAL SOUND LEVELS

It shall be read from Table 4.2 in Section 4.0 of this report, that the external sound levels taken by means of average equivalent or maximum sound levels exceed the World Health Organisation requirements for external noise as described by Community Noise Guidelines (1999) in Section 2.5. this report.

5.1.1 Pro PG Acoustic Design Statement

The scope of ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources. New apartments, flats and houses are the most common type of new residential development, however the guidance can also be applied to other types of residential developments such as residential institutions, care homes etc. As such it is directly applicable to this development.

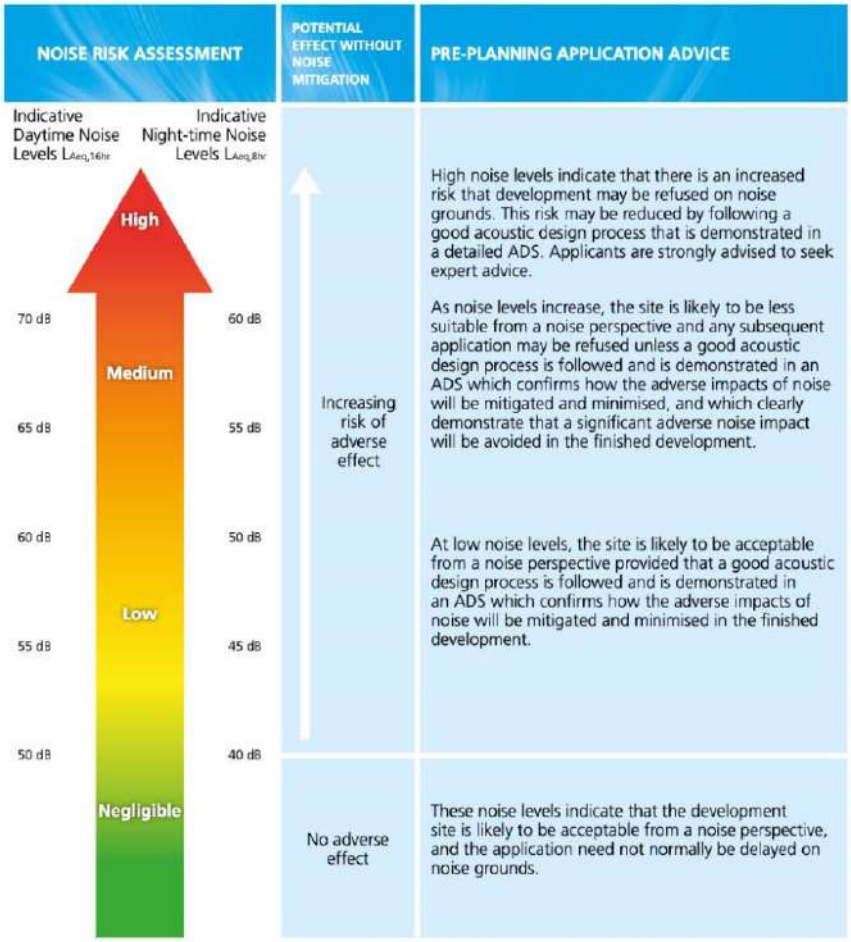


Figure 5.1 - ProPG Noise risk assessment guide

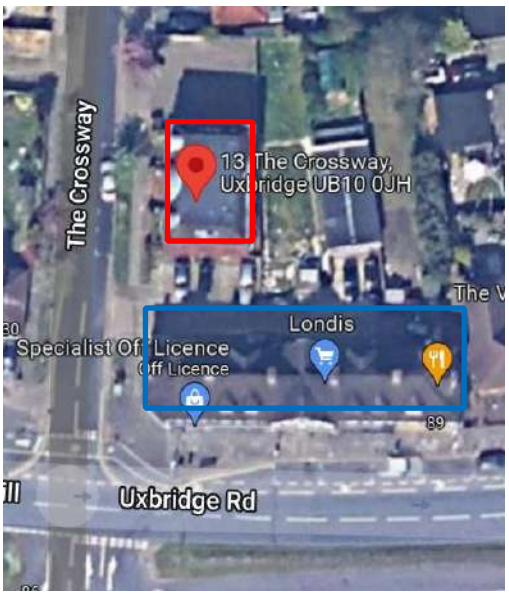
The following table assesses the ProPG noise risk for the measured data. The purpose of this is to provide a view of the noise risk at the site.

	Daytime $L_{Aeq, 16hr}$ 07:00 – 23:00	Night-time $L_{Aeq, 8hr}$ 23:00 – 07:00
Noise Level	62dB	55dB
ProPG Noise Risk	MEDIUM	MEDIUM

Table 5.1.1 : ProPG Stage 1 Assessment table

ProPG states that “Particular care should be taken to ensure that any noise events (as quantified by LAmax,F) have been properly identified and assessed”.

Despite the development site’s proximity to various commercial uses, (See Below) noise levels at the site are dominated by busy / frequent passing road traffic on the Uxbridge Road and The Crossway.



Site	
Commercial Units	

5.2 FAÇADE SOUND INSULATION

In accordance with the assessment guidance in Annex G of BS 8233:2014, the sound insulation performance of the building can be estimated by simple calculation from the free-field noise

CALCULATION		A	B	(A-B) +5
Location	Period	Highest Free-Field Noise Levels LAeq,T dB	BS8233/WHO Internal Noise Guidance Criteria LAeq, T dB	Typical Insulation Specification dB Rw
Gidar House	**Day 07:00 – 23:00**	**62**	**35**	**32**
	Night 23:00 – 07:00	**55**	**30**	**30**
		71	**45**	**31**

Table 5.2 - Sound insulation estimate using the simple calculation method of BS8233

Following the rigorous calculation method of Annex G of BS 8233:2014, it can be shown that a suitable standard of residential amenity can be achieved with façade sound insulation of at least 32dB Rw. $L_{AMAX,F}$ levels are not exceeded on a regular basis.

Detailed calculations are in Appendix D.

5.3 SPECIFICATION OF GLAZED UNITS

The minimum sound reduction index (SRI) value required for the glazed elements to be installed is shown in Table 5.2.

Glazing Configuration – 3mm/ 10mm/ 5 mm							
Frequency, Hz/dB					Rw	Rw + C	Rw +Ctr
125	250	500	1K	2K	**32**	32	29
21	25	27	34	39			

Table 5.2 – Required Glazing Performance

The sound reduction performance stated above must be achieved by the gazing system as a whole in its installed condition. The specification therefore applies to both the glazing element and all seals on any openable part of the system. It should be confirmed with any supplier that the full glazing system supplied complies with the requirements stated in Table 5.2. Glazing data provided by Guardian Glass. (See Appendix C)

6.0 VENTILATION AND OVERHEATING

It is usually assumed that a partially opened window will have a sound reduction of around 13 dB, regardless of the acoustic performance of the window. If 13 dB is subtracted from the measured onsite noise levels displayed in Table 4.1, it can be demonstrated that internal noise levels would be in excess of the maximum recommended internal noise levels displayed in Table 2.4.1.

As a consequence, it will be necessary to ensure that ventilation is adequate such that the design of the building does not rely on windows being opened to ensure that the dwellings are well ventilated. Any ventilation system must be designed such that the noise generated by the system itself is controlled, such that when noise from the system is combined with noise from external sources, internal noise levels do not exceed the maximum noise levels suggested in BS 8233. To ensure that noise from services does not increase internal noise levels, the following guideline internal noise criteria should be utilised:

- Bedrooms NR20
- Living Rooms NR25
- Bathrooms/kitchens NR30-35
- Corridors NR30-35

It should be noted that windows to properties should not be sealed, as this can create an overly oppressive living environment.

Furthermore, it is recommended that windows are openable for times when additional purge ventilation is required, for example the purging of fumes from burnt food when cooking or removal of fumes when painting.

To stairwells, no specific acoustic measures would be necessary and standard trickle vents would be appropriate.

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7.0 CALCULATION RESULTS

Monitoring Period	Calculated Internal Noise Levels	Noise Crieria
07:00 – 23:00	31dB LAeq(16hr)	35 dB
23:00 – 07:00	24dB LAeq(8hr)	30 dB
23:00 – 07:00	40dB LAMAX(8hr)	45dB

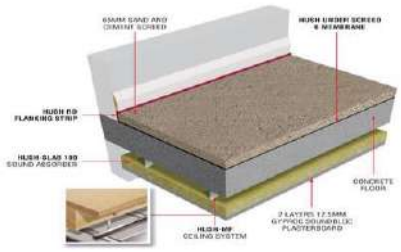
Table 7.0 – Calculation Results

8.0 INTERNAL SOUND INSULATION ASSESSMENT

The floor and wall structure may be subject to pre-completion testing in accordance with requirements of The Building Regulations 2010 Approved Document E (2003 Edition & amendments). It should be expected that the proposed dwelling will exceed the minimum performance standards of the Regulations, as stipulated between dwellings in terms of dB DnT,w +Ctr.

8.1 PROPOSED FLOOR SYSTEM

A 150mm (125mm if only pendant lighting is required) suspended ceiling incorporating 100mm mineral wool with a density of 45kg/m3 rigid slab to be installed.



A separation gap with a minimum 3mm must be left between walls and floor and then filled with acoustic sealant to prevent flanking noise.

25mm Resilient bars to be installed and fitted with 2x layer of Soundbloc Plasterboard with staggered joins.

To mitigate impact noise a resilient layer no less than 8mm should be laid on the slab surface.

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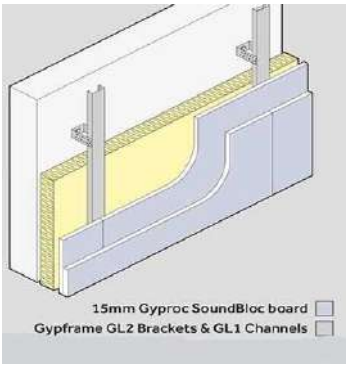
8.2 PARTY WALLS

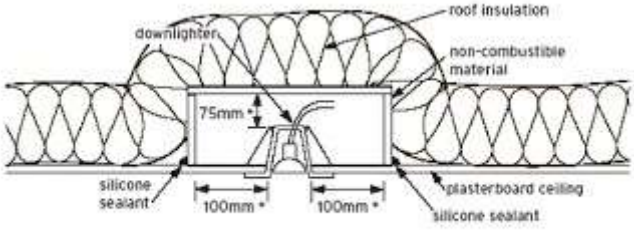
Separating walls are to be built as British Gypsum Quiet Wall, high performance acoustic wall system. Mineral wool infill to be a minimum of 50mm Rw45. (See Detail Below).



Alternatively, 75mm CLS stud wall with a 75mm cavity can be erected and secured via the ceiling joist and floor joist but not the party wall directly. The wall must sit on a 15mm strip of Soundbloc Plasterboard (Blue Board) between floor and ceiling to act as a deflection strip and minimise flanking noise. The cavity must be insulated with Rw45/50mm Mineral wool with 45kg/m3 density and left with a clear 25mm airgap. Fitting of one side of the party wall would be sufficient on solid construction.

8.3 LIGHTING

Any down lighting will be boxed with 15mm Sounbloc plasterboard and sealed with acoustic sealant from above. Alternatively, an acoustic downlight unit would be suitable.



* or clearance as recommended by the fitting manufacturer

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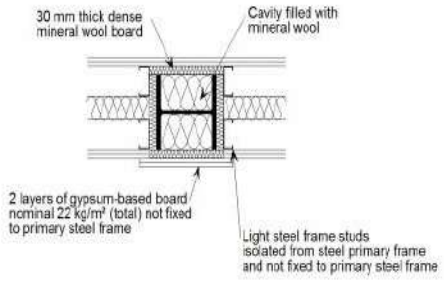
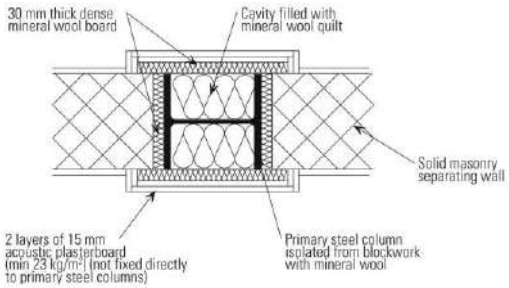
8.4 STEEL BEAMS & WASTE PIPES

All steel beams and waste pipes should be boxed and infilled with 100mm 45kg/m3 mineral wool and encased with 15mm soundbloc plaster board, where possible a 20-25mm air gap should be incorporated.



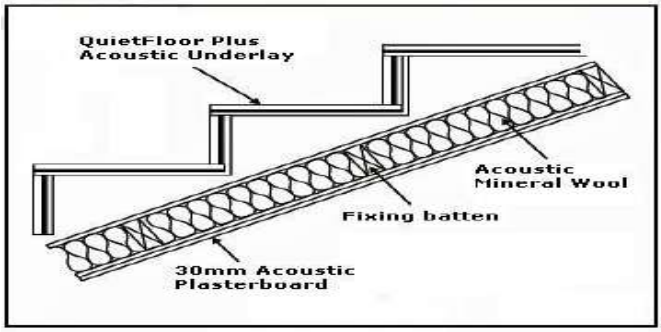


8.5 COMMUNAL AREAS

Soft closers are to be installed to communal and residential main doors to prevent high Reverberation Time (RT60) i.e slamming door.
Acoustic seals and drop seals to be installed to all main residential doors to prevent break in noise.

8.6 PARTY STAIRCASE

Party walls with stairs adjoining will be lined with15mm Soundbloc plasterboard.
The stair treads will have Acoustilay 8 or equivalent glued to each individual tread to prevent impact noise.



8.7 ENTRANCE DOORS

Entrance doors should have a double acoustic seal to prevent noise break in form communal hallways.

9.0 SUMMARY AND CONCLUSIONS

A baseline noise survey has been undertaken by DAA Group to establish the prevailing noise climate in the locality of Gidar House, 13 The Crossway, Uxbridge, Hillingdon, Greater London, UB10 0JH in support of a Prior Approval Application for a proposed change of use to residential units in accordance with the Permitted Development legislation requirement allowing Local Planning Authorities to consider potential impacts of noise specifically from commercial premises on intended occupiers of residential developments.

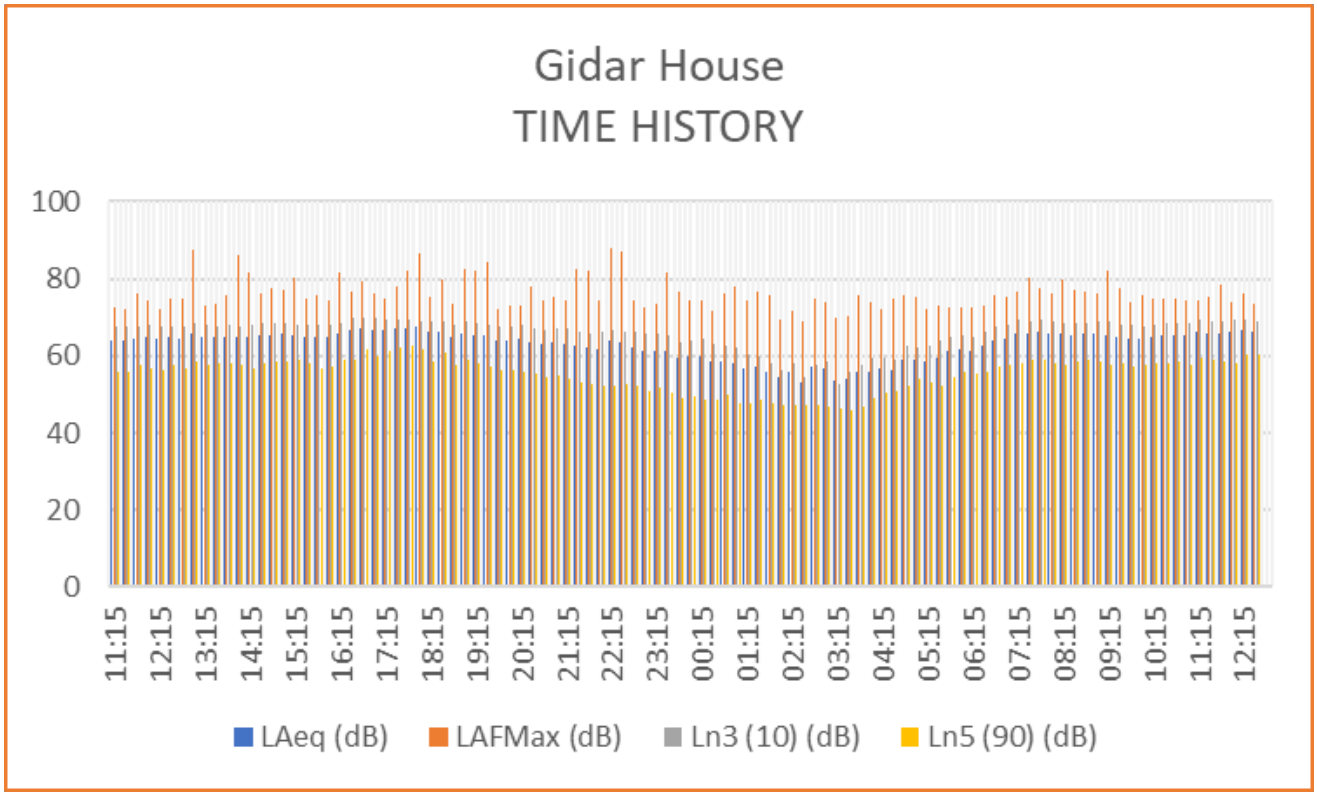
Under Permitted Development legislation there is no requirement to consider noise from transport infrastructure type sources such as road traffic. Notwithstanding this, assessment of noise to the proposed change of use residential development in this report unavoidably includes noise from road traffic as being the principle and dominant source. This is provided as good practice, for completeness and as informative to the developer, rather than as being required by Permitted Development legislation.

Using results of the noise survey, the sound insulation performance for the whole building envelope including glazing (windows) is assessed, and a scheme of noise mitigation measures is established and included in the report verified by BS8233:2014 rigorous method building envelope sound insulation calculations.

A scheme of noise mitigation measures in the report provides specification details as appropriate for sound insulation upgrade treatment to the separating walls and separating floors.

It is concluded that, the impact of noise from commercial premises will not prejudice the amenities of any future occupants provided the above points are taken into consideration

APPENDIX A – MEASUREMENTS



APPENDIX B - ACOUSTIC TERMINOLOGY

B.1 WEIGHTED DECIBEL, dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise, and a change of 2 to 3 dB is subjectively barely perceptible.

B.2 EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{Aeq}. This is a notional steady level which would, over a given period, deliver the same sound energy as the actual timevarying sound over the same period.

B.3 MAXIMUM NOISE LEVEL, LAmax

The maximum noise level identified during a measurement period. Experimental data has shown that the human ear does not generally register the full loudness of transient sound events of less than 125 ms in duration.

B.4 NOISE RATING, NR

Noise ratings are used as a single figure criterion for specifying services noise in buildings. Each noise rating value has an associated spectrum of defined values in each third or octave frequency band. To determine the noise rating of a room the measured spectrum is compared to a set of noise rating curves. The highest NR curve that crosses any single frequency band of the measurement determines the noise rating for the room. The single figure noise rating is read at the 1 kHz band.

B.5 SOUND LEVEL DIFFERENCE (D)

The sound insulation required between two spaces may be determined by the sound level difference needed between them. A single figure descriptor which characterises a range of frequencies, the weighted sound level difference, D, is sometimes used (BS EN ISO 717-1). This parameter is not adjusted to reference conditions.

The standardized level difference, Dn, T is a measure of the difference in sound level between two rooms, in each frequency band, where the reverberation time in the receiving room has been normalised to 0.5 s. This parameter measures all transmission paths, including flanking paths.

The weighted standardized level difference, DnTw, is a measure of the difference in sound level between two rooms, which characterises a range of frequencies and is normalised to a reference reverberation time

B.6 SOUND REDUCTION INDEX (R)

The sound reduction index (or transmission loss) of a building element is a measure of the loss of sound through the material, i.e. its attenuation properties. It is a property of the component, unlike the sound level difference which is affected by the common area between the rooms and the acoustic of the receiving room. The weighted sound reduction index, Rw, is a single figure description of sound reduction index characterising a range of frequencies, which is defined in BS EN ISO 717-1: 1997. The Rw is calculated from measurements in an acoustic laboratory

B.7 STATISTICAL NOISE LEVELS (L_{A90}, (T) L_{A1}, (T) L_{A10}, (T) etc.)

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{A10} is the level exceeded for ten per cent of the time under consideration, has historically been adopted in the UK for the assessment of road traffic noise. The LA90 is the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L_{A1} the level exceeded for one per cent of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted LA10, dB LA90, dB. etc. The reference time (T) is normally included, e.g. LA10, (5min), & LA90, (8hr).

B.8 TYPICAL NOISE LEVELS

Typical noise levels are given in the following table.

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-offs at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy lorries at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heaters at 1m
40	Living room
30	Ventilation Noise in Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing.

APPENDIX C – GLAZING SPECIFICATION

GUARDIAN GLASS

Acoustic Performance

Glazing Configuration

3mm Float Glass

10mm Cavity

5mm Float Glass

Sound Reduction Indices

Frequency, Hz / dB						Rw	C	Ctr	OITC	STC
125	250	500	1000	2000	4000	32	0	-3	27	32
21	25	27	34	39	25					

Disclaimer: The acoustic performance data provided in the reports is based on a test protocol or an estimation and may be used if user actual glazing is identical to input data described herein. Acoustic performance data herein is only applicable for glazing dimensions 1.23 m x 1.48 m (as per testing standard). Estimation of acoustic performance is based on component-similarity assumptions which are derived from measured data and interpolation to expand the database of values from test protocols. Due to inherent variations in acoustic performance when testing in accordance with EN ISO 10140-3/EN ISO 10140-2, some variation in the calculated performance can also be expected. As such, the weighted performance, Rw, and adaptation terms, C and Ctr, should typically be considered to be accurate within ±2 dB. However, wider deviations can occur. Actual performance may vary according to the glazing dimensions, frame system, noise sources and many other parameters. The acoustic performance data herein should not be used as a substitute for tests of actual glazing. For more information please consult Assumptions and Terminology section in Guardian Acoustic Assistant.

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APPENDIX D – CALCULATIONS

0	Daytime (07:00 - 23:00)								
1	Room Width		3.7	Area	37	$L_{eq,2}$	31		
2	Room Height		2.5	RT	0.5				
3	Room Depth		4	A	11.9	S	26.46		
4				A_0	10				
5	Mid-Octave Freq (Hz)	63	125	250	500	1k	2k	4k	8k
6	$L_{eq,ff}$	67	67	61	60	58	53	45	45
7	Vent $D_{n,e}$	50	50	50	50	50	50	50	50
8	$(A_0/S)*10(-D_{n,e}/10)$	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9			S_w	2.16					
10	WindowR_w	21	21	25	27	34	39	25	25
11	$(S_w/S)*10(-R_w/10)$	0.00065	0.00065	0.00026	0.00016	0.00003	0.00001	0.00026	0.00026
12			S_{ew}	9.3					
13	Wall R_{ew}	34	41	43	48	50	55	60	62
14	$(S_{ew}/S)*10(-R_{ew}/10)$	0.00014	0.00003	0.00002	0.00001	0.00000	0.00000	0.00000	0.00000
15			S_{rf}	15					
16	Roof R_w	33	37	42	45	52	54	58	60
17	$(S_{rf}/S)*10(-R_{rf}/10)$	0.00028	0.00011	0.00004	0.00002	0.00000	0.00000	0.00000	0.00000
18	Internal SPL	44	42	32	29	21	12	16	16
19	A-Weighting	-26	-16.1	-8.6	-3.2	0	1	1.2	0
20	A-Weighted levels	18	26	24	26	21	13	17	16
21		60.0	432.5	242.8	403.3	121.3	19.4	48.6	36.8

Night-time (23:00 - 07:00)

1	Room Width		3.7	Area	37	$L_{eq,2}$	24		
2	Room Height		2.5	RT	0.5				
3	Room Depth		4	A	11.9	S	26.46		
4				A_0	10				
5	Mid-Octave Freq (Hz)	63	125	250	500	1k	2k	4k	8k
6	$L_{eq,tr}$	60	60	54	53	51	46	39	39
7	Vent $D_{n,e}$	50	50	50	50	50	50	50	50
8	$(A_0/S)*10(-D_{n,e}/10)$	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9			S_{wi}	2.16					
10	Window R_{wi}	21	21	25	27	34	39	25	25
11	$(S_{wi}/S)*10(-R_{wi}/10)$	0.00065	0.00065	0.00026	0.00016	0.00003	0.00001	0.00026	0.00026
12			S_{ew}	9.3					
13	Wall R_{ew}	34	41	43	48	50	55	60	62
14	$(S_{ew}/S)*10(-R_{ew}/10)$	0.00014	0.00003	0.00002	0.00001	0.00000	0.00000	0.00000	0.00000
15			S_{rr}	15					
16	Roof R_w	33	37	42	45	52	54	58	60
17	$(S_{rr}/S)*10(-R_{rr}/10)$	0.00028	0.00011	0.00004	0.00002	0.00000	0.00000	0.00000	0.00000
18	Internal SPL	37	35	25	22	14	5	10	10
19	A-Weighting	-26	-16.1	-8.6	-3.2	0	1	1.2	0
20	A-Weighted levels	11	19	17	19	14	6	11	10
21		12.0	86.3	48.4	80.5	24.2	3.9	12.2	9.2

	Night-time (23:00 - 07:00)			LAMAX					
1	Room Width		3.7	**Area**	**37**	$L_{eq,2}$	**40**		
2	Room Height		2.5	**RT**	**0.5**				
3	Room Depth		4	**A**	**11.9**	**S**	**26.46**		
4				A_0	**10**				
5	Mid-Octave Freq (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
6	$L_{eq,ff}$	**76**	**76**	**70**	**69**	**67**	**62**	**54**	**54**
7	**Vent $D_{n,e}$**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**
8	$(A_0/S)*10(-D_{n,e}/10)$	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9			S_{wi}	**2.16**					
10	**Window R_{wi}**	21	21	25	27	34	39	25	25
11	$(S_{wi}/S)*10(-R_{wi}/10)$	0.00065	0.00065	0.00026	0.00016	0.00003	0.00001	0.00026	0.00026
12			S_{ew}	**9.3**					
13	**Wall R_{ew}**	**34**	**41**	**43**	**48**	**50**	**55**	**60**	**62**
14	$(S_{ew}/S)*10(-R_{ew}/10)$	0.00014	0.00003	0.00002	0.00001	0.00000	0.00000	0.00000	0.00000
15			S_{rr}	**15**					
16	**Roof R_w**	**33**	**37**	**42**	**45**	**52**	**54**	**58**	**60**
17	$(S_{rr}/S)*10(-R_{rr}/10)$	0.00028	0.00011	0.00004	0.00002	0.00000	0.00000	0.00000	0.00000
18	**Internal SPL**	**53**	**51**	**41**	**38**	**30**	**21**	**25**	**25**
19	A-Weighting	-26	-16.1	-8.6	-3.2	0	1	1.2	0
20	**A-Weighted levels**	**27**	**35**	**33**	**35**	**30**	**22**	**26**	**25**
21		476.9	3435.1	1928.7	3203.6	963.2	154.1	386.2	292.4

T: +44(0)207 101 9669. F: +44(0)1252 337266. E: enquiries@daagroup.co.uk