

Environmental Noise Impact Assessment Report for Planning

200-202 Broad Street, Reading, RG1 7QJ

Report Reference 20418.ENIA.RPT.01 Rev A

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Revision Reference	Issue Date	Purpose and/or Description of Revision
First Issue	2 nd May 2023	Environmental noise impact assessment report prepared in support of a planning application for the development of a fourth floor and mansard roof extension to the existing TSB bank building. The roof extension will comprise an increased parapet height to create a formal additional storey and a single-storey mansard roof above to facilitate the provision of six self-contained flats.
Rev A	24 th November 2023	Report updated further to comments received from Environmental Protection (Tom Bradfield) reference EP /765426. Section 6.3.1 updated accordingly.

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EXECUTIVE SUMMARY

Environmental noise surveys and a noise impact assessment has been undertaken for the Proposed Development at 200-202 Broad Street, Reading, RG1 7QJ.

An initial appraisal of the site determined road traffic noise from the surrounding roads to be the dominant source affecting the site.

Noise levels measured on site are shown in below:

Position	Façade Facing Direction	Period	Residual Sound Level $L_{Aeq, T}$ (dB)	Minimum Background Noise Level L_{A90} (dB)	10 th Highest Maximum Noise Level L_{AFmax} (dB)
1	East	Daytime 07:00-23:00	67	51	n/a
		Night-time 23:00-07:00	62	42	82
2	South	Daytime 07:00-23:00	65	53	n/a
		Night-time 23:00-07:00	59	43	80
3	North	Daytime 07:00-23:00	56	48	n/a
		Night-time 23:00-07:00	47	42	54

Noise impacts on the proposed development have been assessed against the guidance presented in 'Professional Practice Guidance on Planning and Noise' (ProPG), BS 8233:2014, as well as Local and National Planning Policy Guidelines.

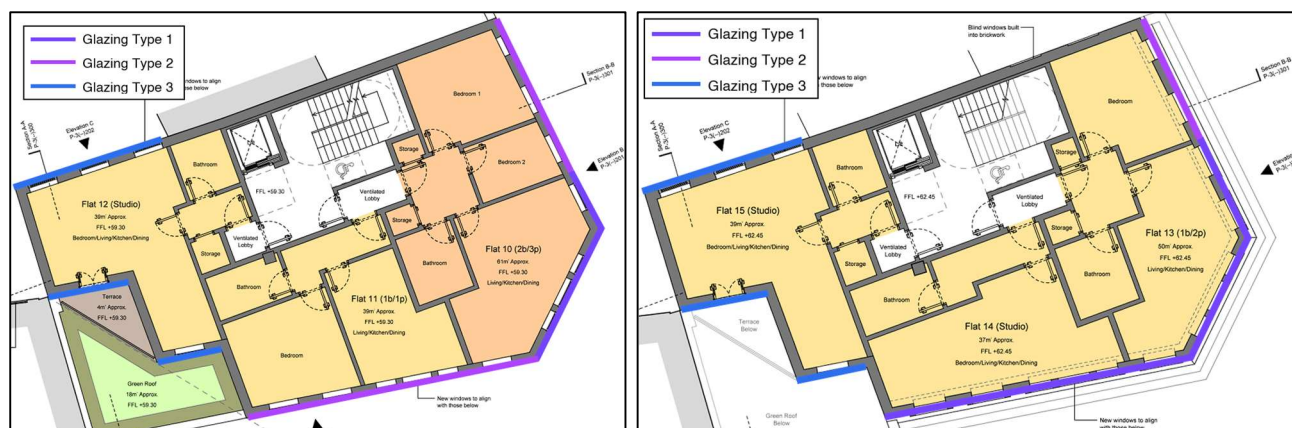
When assessed against the initial risk assessment criteria of ProPG, it has been found that the development site broadly falls within the 'medium' risk category during both daytime and night-time with regards to adverse effects from noise, when considered in the absence of mitigation proposals.

Noise mitigation measures have been suggested to avoid significant adverse effects and minimise adverse effects.

Calculations have been undertaken to determine a suitable glazing specifications for the development. Minimum octave band sound reduction index (SRI) values required for all glazed elements to be installed are shown in the table below:

Glazing Type	Octave band centre frequency SRI, dB						R_w (C;C _{tr})
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Type 1	-25	-25	-33	-42	-47	-48	38 (-2;-5)
Type 2	-26	-22	-33	-41	-45	-43	36 (-2;-5)
Type 3	-23	-20	-28	-39	-44	-37	33 (-2;-5)

The Glazing Types are marked up on the proposed floor plans in the figures below for ease of reference:



With regards to ‘whole dwelling ventilation’, based on the noise levels measured on site, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation.

The mechanical ventilation system should be designed to meet the internal noise levels as defined in the table below:

Room Type	dB LAeq	NR
Bedrooms / Living Rooms	30	25
Kitchen / Bathrooms	45	40

Purge ventilation (as defined in ADF) would be provided via openable windows, as ‘...the internal noise level guidelines are generally not applicable under ‘purge ventilation’ conditions as defined by Building Control Approved Document F, as this should only occur occasionally.’

Noise limits for any future external plant installations have been set at the nearest noise sensitive receptors based on the methodology of BS 4142:2014+A1:2019 and Local Authority requirements:

Period	Minimum Background Sound Level dB LA90	Maximum Plant Noise Level dB LA _{r,Tr}
Daytime (07:00-23:00)	48 - 53	38 - 43
Night-time (23:00-07:00)	42 - 43	32 - 33

It is unknown at this stage whether plant would be installed and the above is presented as good practice. Due to the variations in the representative background noise levels across the site, noise emission limits for new plant and equipment would depend on the proposed installation location of any future plant, and therefore a range of maximum plant noise levels are provided.

It is concluded that the site is appropriate for residential development.

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1 INTRODUCTION

ES Acoustics Ltd has been commissioned by Thackeray Group to undertake an environmental noise survey and noise impact assessment for the Proposed Development at 200-202 Broad Street, Reading, RG1 7QJ.

The purpose of this report is to;

- Review appropriate National and Local Planning Policy, and Good Practice Guidance relevant to the Proposed Development;
- Determine noise levels incident on the Proposed Development site via an environmental noise survey;
- Determine background noise levels at nearby noise sensitive receptor locations;
- Prepare an initial site risk assessment in accordance with ProPG: Professional Practise Guidance on Planning and Noise; and
- Undertake an acoustic assessment of the external building fabric requirements and where appropriate provide outline mitigation advice.

2 PROPOSED DEVELOPMENT

2.1 Site Description

The application site is located in the centre of Reading. The site comprises the existing five-storey (with basement) building at 200-202 Broad Street, also lesser known as 2-4 Oxford Road, being a prominent corner plot at the four-way junction of Oxford Road, Broad Street, West Street and St Mary's Butts. This junction represents the gateway to the pedestrianised Broad Street and entrance to the main high-street shopping core of Central Reading.

The site boundary is outlined in the figure below:

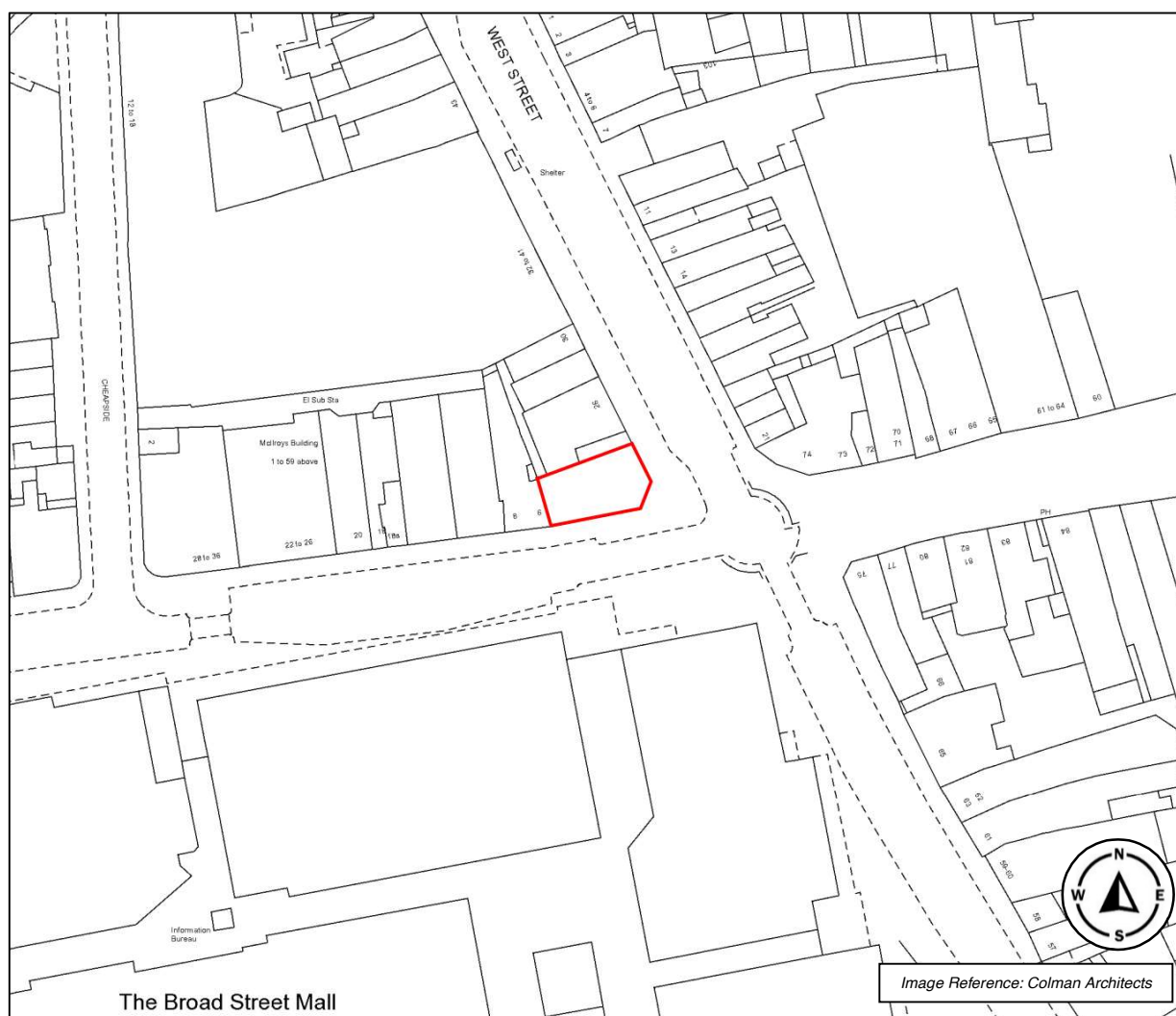


Figure 1 Proposed development site

2.2 Proposal

Planning permission is sought for the development of a fourth floor and mansard roof extension to the existing TSB bank building. The roof extension will comprise an increased parapet height to create a formal additional storey and a single-storey mansard roof above to facilitate the provision of six self-contained flats.

Additional information with regards to the proposal is included within the Planning, Design and Access Statement prepared by Town Planning Bureau (reference URB-555-ST5).

A visual of the massing and design proposal is shown in the figure below:

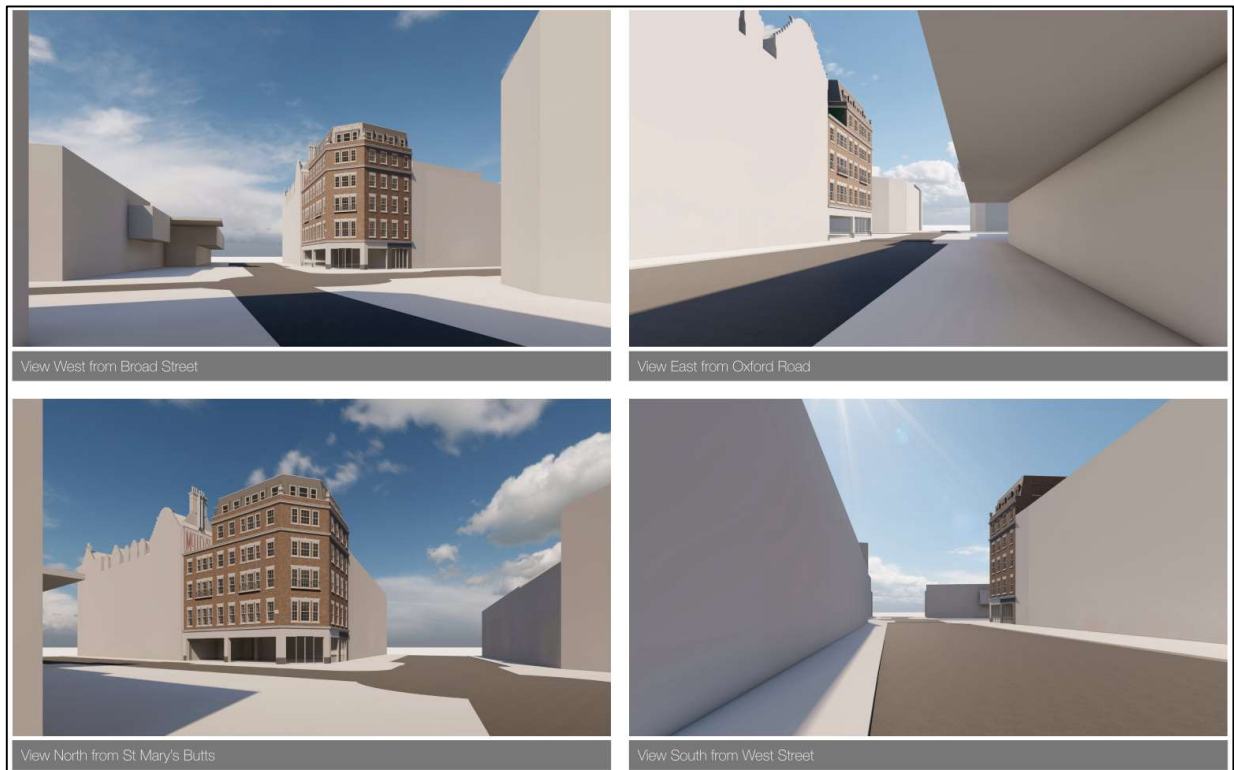


Figure 2 Pre-app 02 design proposal

3 PLANNING POLICY AND GUIDANCE

This section of the report presents the key planning policy and guidance relevant for the assessment of noise for a residential development such as this.

3.1 National Policy

3.1.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) superseded and replaced Planning Policy Guidance Note 24 (PPG24), which previously covered issues relating to noise and planning in England.

The paragraphs relating to noise state:

174. *Planning policies and decisions should contribute to and enhance the natural and local environment by; [...]*
- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans*
185. *Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
- a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; [...]*
187. *Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*

3.1.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The long-term vision of the Government noise policy is to *'Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.'*

The NPSE vision noted above is supported by 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 outlines observed effect levels relating to the above, as follows:

- *No observed effect level (NOEL): this is the level of noise exposure below which no effect at all on health or quality of life can be detected;*
- *Lowest observed adverse effect level (LOAEL): this is the level of noise exposure above which adverse effects on health and quality of life can be detected;*
- *Significant observed adverse effect level (SOAEL): This is the level of noise exposure above which significant adverse effects on health and quality of life occur;*

Noise effect levels are not set at absolute noise level targets, but instead vary depending on the context and character of the noise and site-specific factors which may impact on the severity of the effect. The NPSE states:

'It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.'

3.1.3 National Planning Practice Guidance (NPPG)

The NPPG provides practical guidance on how the NPPF should be applied as well as and guidance on the factors influencing whether noise may be a concern at the planning stage and how adverse effects can be mitigated. The table below summarises the effect levels presented within the NPSE, as follows:

Response	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific Measures required
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate & reduce to a minimum
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1 Noise exposure hierarchy

3.2 Local Policy

Planning applications within the Reading Borough Council are determined with regard to the current planning policies adopted by the Council, which are broadly outlined within the Reading Borough Council Local Plan (adopted November 2019). The key policies relating to noise are:

Policy CC8: Safeguarding Amenity

Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

- *Privacy and overlooking;*
- *Access to sunlight and daylight;*
- *Visual dominance and overbearing effects of a development;*
- *Harm to outlook;*
- *Noise and disturbance;*
- *Artificial lighting;*
- *Vibration;*

- *Dust and fumes;*
- *Smell;*
- *Crime and safety; or*
- *Wind, where the proposals involve new development of more than 8 storeys.*

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy. As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable. Where an otherwise acceptable development could change its character to a use that would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes.

Policy EN16: Pollution and Water Resources

Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution; where it would result in no deterioration in, or ideally enhance, ground and surface water quality; and where adequate water resources, sewerage and wastewater treatment infrastructure will be in place to support the proposed development prior to occupation.

Proposals for development that are sensitive to the effects of 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.

Development will only be permitted on land affected by contamination where it is demonstrated that the contamination and land gas can be satisfactorily managed or remediated so that it is suitable for the proposed end use and will not impact on the groundwater environment, human health, buildings and the wider environment, during demolition and construction phases as well as during the future use of the site.

Policy EN17: Noise Generating Equipment

Where noise generating equipment is proposed, the noise source specific level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor.

Policy CR6: Living in Central Reading

- All proposals for residential development within the central area will be required to contribute towards a mix of different sized units within the development. This will be measured by the number of bedrooms provided within individual units. Ideally, a mixture of one, two and three bedroom units should be provided. As a guide, in developments of 15 dwellings or more, a*

maximum of 40% of units should be 1-bed/ studios, and a minimum of 5% of units should be at least 3-bed, unless it can be clearly demonstrated that this would render a development unviable.

- ii) Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated.*
- iii) In meeting the requirement to provide affordable housing, in the central area an overconcentration of social renting for single persons will be avoided.*
- iv) Where proposals for serviced apartments and apart-hotels fall outside the C3 use class, they will be located within the Central Core. Such proposals will not be permitted unless the duration of occupation of residents is restricted, to ensure the units are used on a short stay basis and not as residential flats, and information monitoring the implementation of this restriction is regularly supplied.*

3.3 Best Practice and Guidance

3.3.1 World Health Organization (WHO) Guidelines

WHO Guidelines for Community Noise (1999) provides guideline values for community noise in specific environments. This has since been supplemented by WHO Environmental Noise Guidelines for European Region (WHO, Regional office for Europe, 2018).

The WHO guideline values most relevant to new residential development are outlined in the table below:

Specific Environment	Critical Health Effects	L _{Aeq, T} [dB]	L _{Afmax} [dB]
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	n/a
	Sleep disturbance night-time	30	45

Table 2 Guideline Values from WHO Guidelines for Community Noise (1999)

The effects of noise in dwellings are typically sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms at night are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events, but the guidance also notes that lower noise levels may be disturbing depending on the nature of the noise source.

3.3.2 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

Table 4 of BS 8233:2014 (reproduced below) provides guidance on recommended internal ambient noise levels in residential spaces based on World Health Organisation (WHO) research.

Room	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Living Room	≤ 35 dB $L_{Aeq,16hr}$	N/A
Dining Room	≤ 40 dB $L_{Aeq,16hr}$	N/A
Bedroom	≤ 35 dB $L_{Aeq,16hr}$	≤ 30 dB $L_{Aeq,8hr}$

Table 3 BS 8233:2014 indoor ambient noise levels for dwellings

The following notes should be considered alongside the levels presented above:

- The levels presented above are for steady external noise sources without a specific character. Noise is considered to have a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate*
- The levels are based on annual average data and do not have to be achieved in all circumstances e.g. it is normal to exclude occasional events, such as fireworks night or New Year's Eve*
- Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved*
- If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level*
- The levels outlined above are not applicable under "purge ventilation" conditions as defined by Approved Document F of the Building Regulations, as this should only occur occasionally e.g. to remove odour from painting or burnt food). However, the levels above should be achieved whilst providing sufficient background ventilation, either via passive or mechanical methods*

It should be noted that the 2014 version of BS 8233:2014 does not include any specific requirement for maximum instantaneous noise levels (L_{max}) within dwellings. However, methodology for the assessment of maximum noise levels is included in ProPG (Section 3.3.3) and referenced in WHO guidelines above.

With regards to external amenity spaces, BS 8233:2014 notes:

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

3.3.3 ProPG: Professional Practise Guidance on Planning and Noise

ProPG was published to provide practitioners with guidance and a recommended approach for the assessment of noise impact on residential developments during the planning stage.

The 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 the key elements described in ProPG.

The guidance seeks to assist in the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise and encourage a good acoustic design in and around proposed new residential development whilst considering national policy on planning and noise.

The recommend approach for assessment is summarised below:

- *Stage 1 – an initial noise risk assessment of the proposed development site*
- *Stage 2 – a systematic consideration of four key elements:*
 - *Element 1 – Demonstrating a “Good Acoustic Design Process” (including feasibility of reducing or relocating existing noise sources, site orientation and building layout and appropriate constructions methods to meet performance requirements);*
 - *Element 2 – Observing internal “Noise Level Guidelines” (as presented in Section 3.3.1 of this report, with additional consideration of individual noise events which should normally not exceed L_{AFmax} 45 dB more than 10 times in bedrooms at night);*
 - *Element 3 – Undertaking an “External Amenity Area Noise Assessment” (ProPG aligns with BS 8233:2014 and suggests that noise levels in external amenity areas should ideally not be above $L_{Aeq, 16hr}$ 50-55dB. However, there is an acceptance that these guideline values may not be achievable in all circumstances where development might be desirable, and in such situations, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited.); and*
 - *Element 4 – Consideration of “other relevant issues” (including compliance with national and local policy, acoustic design vs unintended adverse consequences, acoustic design vs wider planning objectives)*

To help consider noise at a site at an early stage an initial noise risk assessment should assess the Noise Risk Category of the site to help provide an indication of the likely suitability of the site for new residential development from a noise perspective. The table below sets out the indicative noise levels for the Noise Risk Categories and a description of the potential effect of noise were no further noise mitigation to take place as well as additional guidance.

Noise Risk Category	Potential Effect if <u>Unmitigated</u>	Pre-Planning Application Guidance
0- Negligible $L_{Aeq,16hr} < 50\text{dB}$ $L_{Aeq,8hr} < 40\text{dB}$	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.
1- Low $L_{Aeq,16hr} 50\text{-}60\text{dB}$ $L_{Aeq,8hr} 40\text{-}50\text{dB}$	Increasing risk of adverse effect 	At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
2- Medium $L_{Aeq,16hr} 60\text{-}70\text{dB}$ $L_{Aeq,8hr} 50\text{-}60\text{dB}$		As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
3- High $L_{Aeq,16hr} > 70\text{dB}$ $L_{Aeq,8hr} > 60\text{dB}$		High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

Table 4 ProPG Stage 1 Site Noise Risk Assessment

Notes on Table 4 ProPG Stage 1 Site Noise Risk Assessment:

- Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.
- Indicative 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 is “not dominant”.
- $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.
- An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F} > 60\text{ dB}$ means the site should not be regarded as negligible risk.

Whilst the assessment outlined in this report does not necessarily constitute a full assessment in accordance with the ProPG, the assessment methodology and criteria used have been based on the principals and guidance outlined in the ProPG document.

A Stage 1 Risk Assessment is presented in Section 5, with the key elements outlined in the Stage 2 Assessment being covered in Sections 6.

3.4 BS 4142: 2014+2019 ‘Methods for rating and assessing industrial and commercial sound’

BS 4142 provides a methodology for rating and assessing the impacts of industrial and commercial sound at noise sensitive receptors.

The methodology involves comparing the Rating Noise Level due to the sound source/s under assessment with the existing background noise level (L_{A90}) when the noise source is not operating to estimate the initial impact, as follows:

Typically, the greater this difference, the greater the magnitude of the impact

- a) *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context*
- b) *A difference of around +5 dB could be an indication of an adverse impact, depending on the context*
- c) *The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context*

Note that the assessment reference periods that should be considered are:

- *One hour period for a sound source operating during daytime hours (07:00-23:00 hours)*
- *Fifteen minute period for a sound source operating during the night-time (23:00-07:00 hours)*

The standard notes that a noise source under assessment will have a 'low impact' when the 'rating level' of a noise source is less than the existing background noise. It is also important to note that any quantitative assessment results are assessed in light of the context in which the sound occurs.

With regards to background noise levels, BS 4142 notes:

"In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

4 ENVIRONMENTAL NOISE SURVEY

4.1 Measurement Location and Procedure

Noise surveys were undertaken on the proposed site as shown in the figure below:



Figure 3 Noise survey measurement locations

The locations were chosen to collect data representative of the levels expected on the site due to all nearby sources.

The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*', with automated monitoring undertaken between 11:05 on 19/04/2023 and 11:40 on 20/04/2023 for Noise Monitoring Positions 1 and 2, and between 11:20 on 19/04/2023 and 00:50 on 20/04/2023 for Noise Monitoring Position 3.

The key acoustic descriptors measured for this assessment are as follows:

- $L_{Aeq,T}$ (the continuous equivalent A-weighted noise level over a given time period, T);
- $L_{AFMax,T}$, the maximum sound level over each measurement period;

- $L_{A90,T}$ (the noise level exceeded for 90% of the measurement period T , referred to as the 'background' noise level).

An initial appraisal of the site determined road traffic noise from the surrounding roads to be the dominant source affecting the site. It should be noted that general vehicular access for the public is restricted on both West Street and Oxford Street. Therefore, vehicular traffic surrounding the site is mainly comprised of bus, taxi, moped and delivery vehicle traffic.

In addition to the vehicle traffic on the surrounding roads, the Broad Street Mall and associated rooftop car park lies to the south of the site.

To the north of the site there are a number of plant installations serving the surrounding buildings, although most are at a significant distance from the façade.

The aforementioned car park and plant are more easily seen on the Google Earth view, shown below:

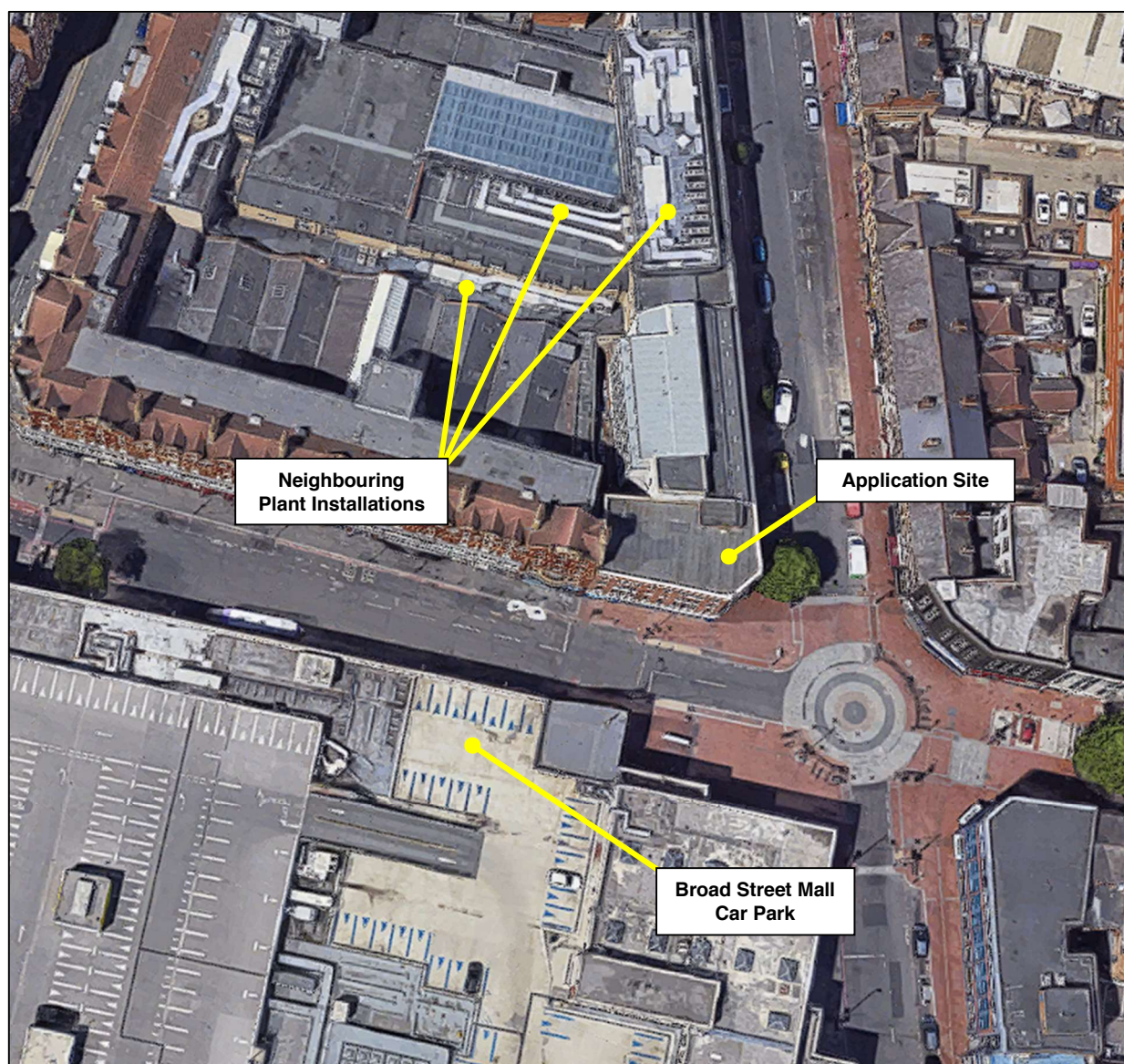


Figure 4 Google Earth aerial view showing surrounding noise sources

4.2 Measurement Equipment

The table below presents the equipment used for the baseline noise surveys. The equipment calibration was verified before and after use and no abnormalities were observed.

Equipment	Make and Model	Serial Number
Sound Level Meter	Svantek 958 Class 1 Sound Level Meter	69897
Microphone Capsule	Svantek MK 255	19233
Microphone Preamplifier	Svantek SV 12L	25991
Sound Level Meter	Svantek 977 Class 1 Sound Level Meter	34191
Microphone Capsule	Svantek MK 255	77747
Microphone Preamplifier	Svantek SV 12L	32446
Sound Level Meter	Convergence Instruments NSRTW MK3 Type 1 Sound Level Meter and Data Logger	CtteDI2Y2d8flrNgYwBRFD
Calibrator	Svantek SV36 Class 1 Sound Calibrator	122255

Table 5 Noise survey equipment

4.3 Weather Conditions

Weather conditions during the automated monitoring were generally dry with light winds and therefore suitable for the measurement of environmental noise.

4.4 Survey Results

Time histories of the survey results are presented in Appendix B1, B2 and B3 for Noise Measurement Positions 1, 2 and 3 respectively. A summary of the measurement results is presented in the table below:

Measurement Position	Period	Residual Sound Level $L_{Aeq, T}$ (dB)	Minimum Background Noise Level L_{A90} (dB)	10 th Highest Maximum Noise Level L_{AFmax} (dB)
1	Daytime 07:00-23:00	67	51	n/a
	Night-time 23:00-07:00	62	42	82
2	Daytime 07:00-23:00	65	53	n/a
	Night-time 23:00-07:00	59	43	80
3	Daytime 07:00-23:00	56	48	n/a
	Night-time 23:00-07:00	47	42	54

Table 6 Measured noise levels

5 INITIAL SITE RISK ASSESSMENT

5.1 Stage 1 Risk Assessment

Based on the automated noise measurements undertaken on site, we would expect worst-case noise levels at 1m from façades with glazed elements to be as shown in the figure below (daytime noise levels shown with the 'D' suffix, night-time levels shown with the 'N' suffix). Appropriate corrections have been applied based on the building envelope with respect to the noise measurement positions and noise source locations as appropriate:

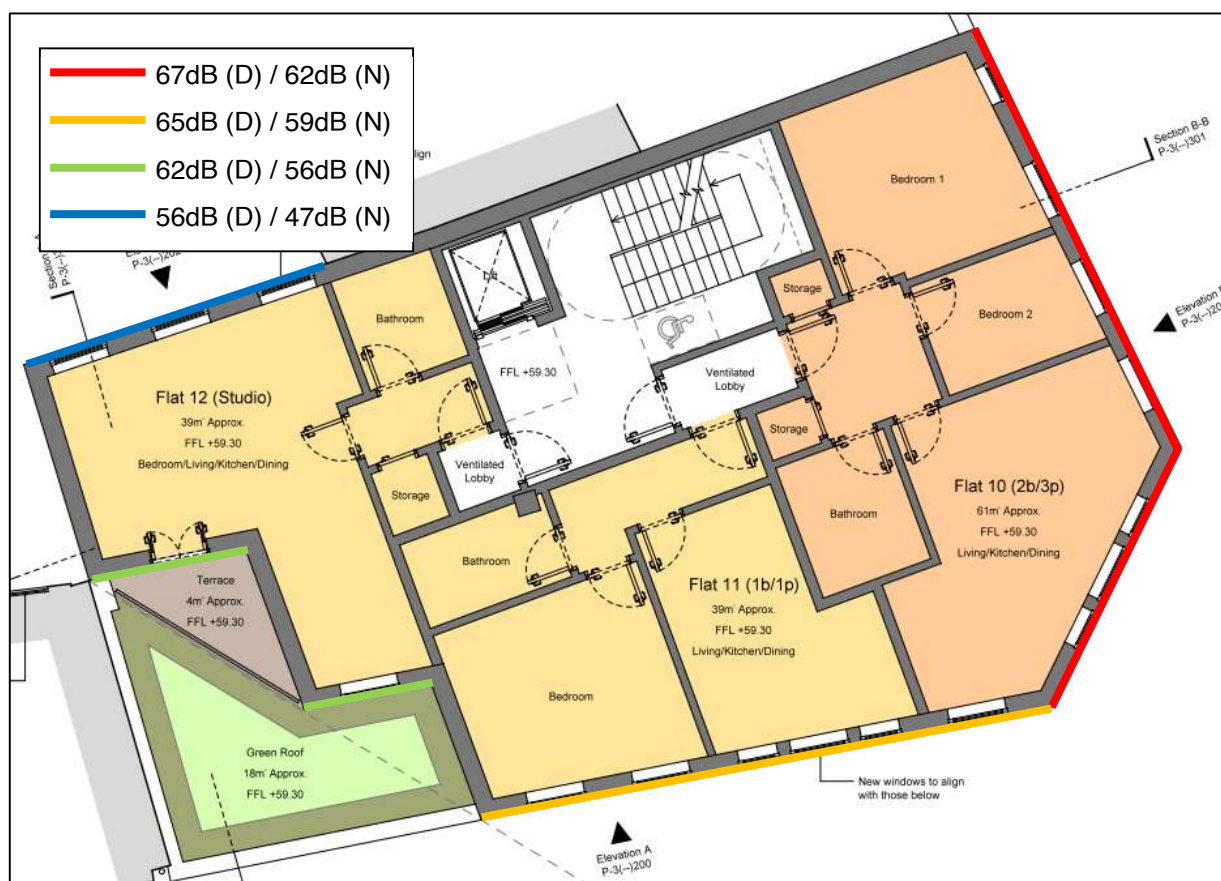


Figure 5 Noise levels during daytime and night-time at 1m from façades

An initial site risk assessment has been undertaken in accordance with the guidance presented in ProPG as shown in the table below:

Façade	Period	Noise Level at 1m from Façade dB LAeq,T	Noise Risk Catagory dB LAeq,T
1 —	Daytime 07:00-23:00	67	2- Medium
	Night-time 23:00-23:00	62	3- High
2 —	Daytime 07:00-23:00	65	2- Medium
	Night-time 23:00-23:00	59	2- Medium
3 —	Daytime 07:00-23:00	62	2- Medium
	Night-time 23:00-23:00	56	2- Medium

Façade	Period	Noise Level at 1m from Façade dB L _{Aeq,T}	Noise Risk Catagory dB L _{Aeq,T}
4 	Daytime 07:00-23:00	56	1- Low
	Night-time 23:00-23:00	47	1- Low

Table 7 Stage 1 risk assessment

As shown in the table above, noise levels for daytime and night-time are broadly within the “medium” noise risk category for the site.

The acoustic design advice provided within the following sections would ensure that noise impacts are sufficiently mitigated against to ensure ‘no adverse effect on health and quality of life’. The design and specifications would ensure that the internal noise level targets outlined in BS 8233:2014 are achieved and a good internal noise climate is provided for future occupants.

6 GLAZING AND VENTILATION

A scheme of suitable noise mitigation measures to protect the proposed dwelling against external noise relates principally to the sound insulation performance of elements of the overall external building envelope. The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes, etc.).

The following sections describe the proposed design measures to achieve the internal ambient noise level criteria.

6.1 Non-Glazed External Building Fabric Construction

It is understood that the non-glazed external building envelope will be formed by blockwork or masonry which will provide a good level of noise insulation by default. Therefore, as for most residential sites, the dominant path for external noise to enter rooms of the proposed dwelling will be via the windows.

The external walls should provide a minimum sound insulation performance of 50dB R_w , which is easily achievable with modern construction methods.

6.2 Glazing Specifications

Calculations have been undertaken to determine a suitable glazing specifications for the development, assuming that the non-glazed external building envelope provides a minimum performance of 50dB R_w as outlined above.

Calculations have been undertaken for the following sample rooms within the development due to the varying ratios of glazing to non-glazing, room dimensions and room absorption characteristics:

- Flat 10 Bedroom 1
- Flat 10 Lounge
- Flat 11 Bedroom 1
- Flat 11 Lounge
- Flat 12 Studio
- Flat 14 Studio

The results of the calculations are shown in Appendix C. The rooms that have not been calculated would be expected to be commensurate to a room calculated e.g. Flat 15 Studio would be commensurate with Flat 12 Studio due to the same ratios of glazing/non-glazing and absorption characteristics.

Minimum octave band sound reduction index (SRI) values required for glazed elements to be installed are shown in the table below:

Glazing Type	Octave band centre frequency SRI, dB						R _w (C;C _{tr})
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Type 1	-25	-25	-33	-42	-47	-48	38 (-2;-5)
Type 2	-26	-22	-33	-41	-45	-43	36 (-2;-5)
Type 3	-23	-20	-28	-39	-44	-37	33 (-2;-5)

Table 8 Glazing specifications

Each performance is specified for the whole window unit including the frame. Sole glass performance data would not demonstrate compliance with this specification. The nominated glazing supplier should verify that their proposed window system meets the attenuation figures shown at each centre frequency band.

Example glazing configurations capable of providing the maximum level of sound insulation required are shown below:

Glazing Type	Calculated Sound Insulation Requirement for Glazing	Example Window Construction Capable of Achieving the Sound Insulation Requirement
Type 1	38 (-2;-5)	4mm glass / 12mm air gap / 6mm laminated glass
Type 2	36 (-2;-5)	4mm glass / 10mm air gap / 8mm glass
Type 3	33 (-2;-5)	4mm glass / 10mm air gap / 4mm glass

Table 9 Example glazing type

The Glazing Types are marked up on the proposed floor plans in the figures below:

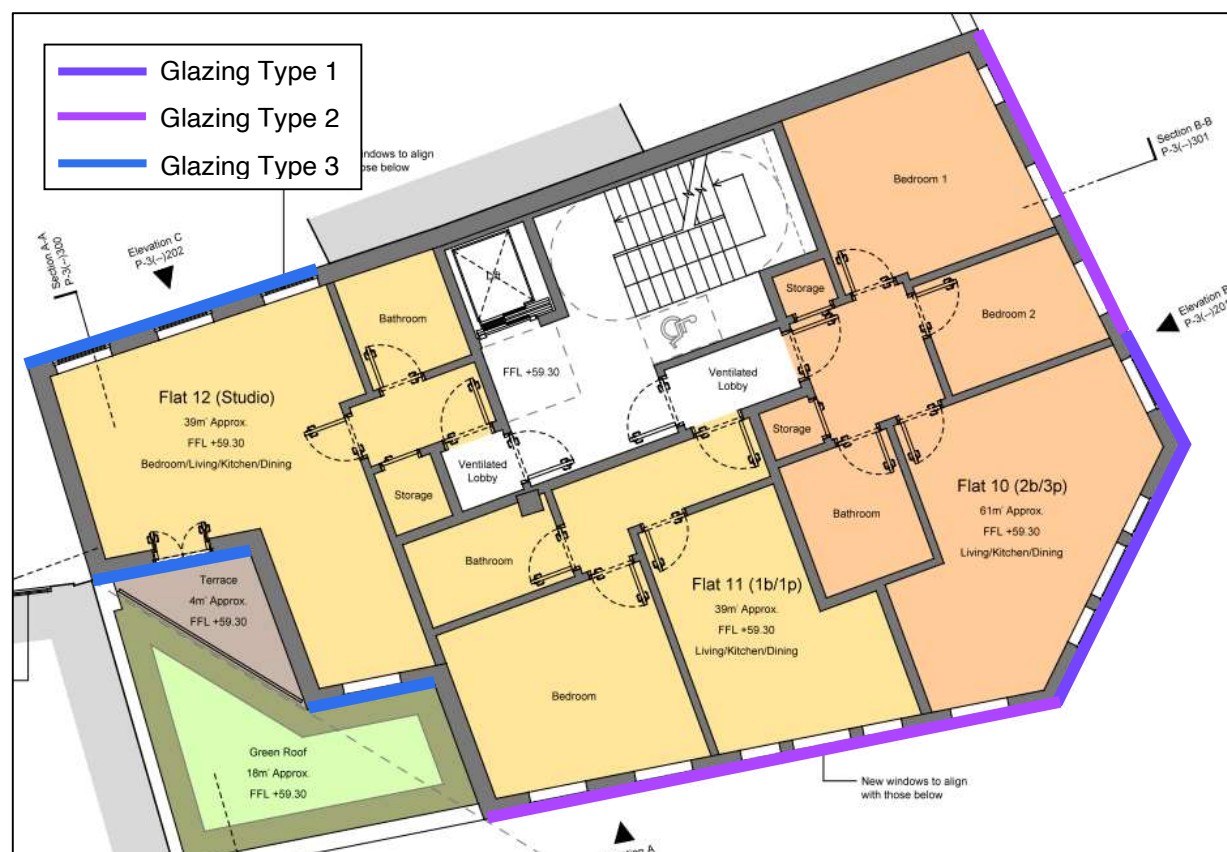


Figure 6 Fourth floor glazing type markup

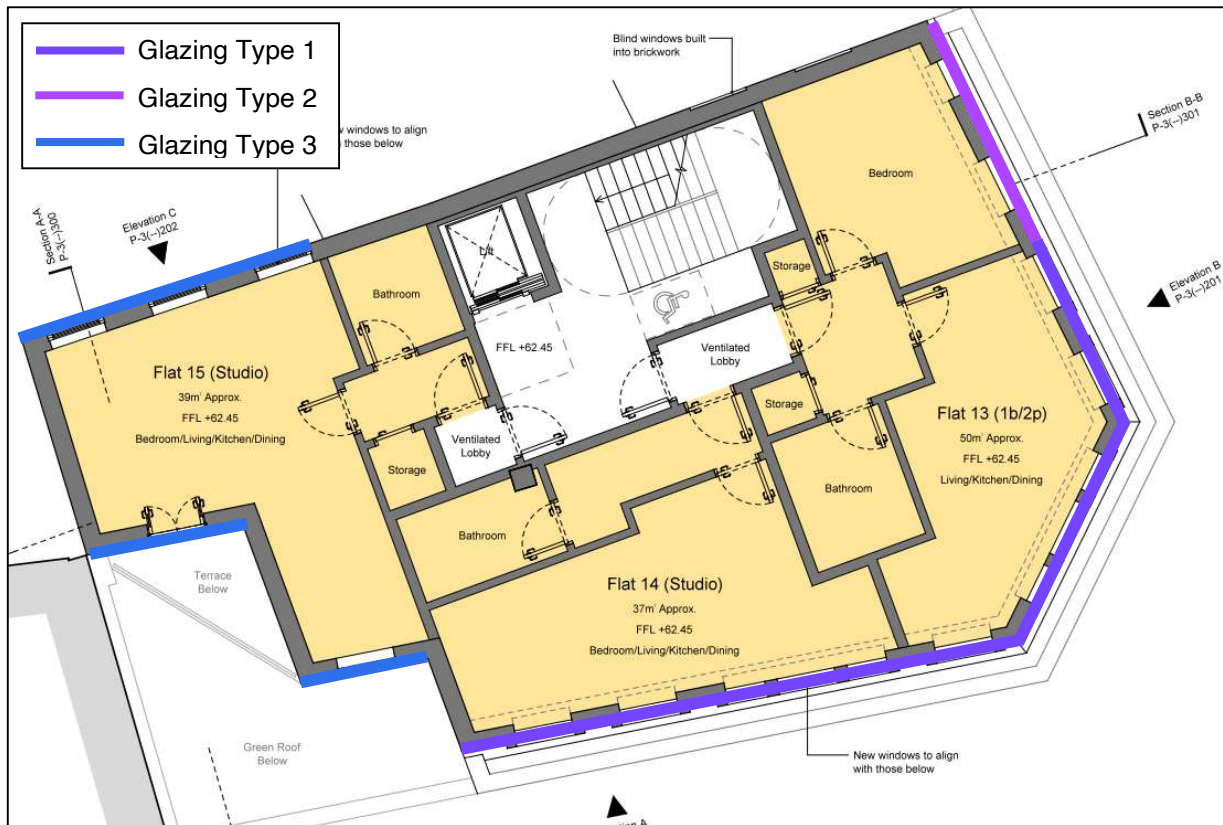


Figure 7 Fifth floor glazing type markup

6.3 Ventilation Specifications

6.3.1 Whole Dwelling Ventilation

Requirement F1(1) of Approved Document F of the Building Regulations requires that ‘there shall be adequate means of ventilation provided for people in the building’.

Since the original issue of this report, feedback was received from the Local Authority Environmental Protection team, as follows:

“Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded.”

For the front façades of the building (noted as Façades 1, 2 and 3 in Figure 5), partially open windows would result in levels greater than 5 dB above the BS 8233:2014 recommended internal levels.

Therefore, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation.

The mechanical ventilation system should be designed to meet the internal noise levels as defined in the table below:

Room Type	dB L _{Aeq}	NR
Bedrooms / Living Rooms	30	25
Kitchen / Bathrooms	45	40

Table 10 ADF guidance levels for mechanical building services

6.3.2 Purge Ventilation

The only time windows will be required to be open for the purpose of ventilation will be for occasional 'purge' ventilation. With respect to noise levels during purge ventilation conditions, ProPG states the following:

'...the internal noise level guidelines are generally not applicable under 'purge ventilation' conditions as defined by Building Control Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).'

It is therefore not considered necessary to further consider noise levels during purge ventilation conditions. Using windows for this purpose is unlikely to result in any significant adverse effects due to the limited time the window would be open, with the occupant having full control over the open condition.

7 RESULTANT INTERNAL NOISE LEVELS

Based on the performance specifications outlined in Section 6, the internal noise levels within living rooms and bedrooms of the proposed development would be as follows:

Flat	Room	Daytime dB LAeq, 16 hour	Night-time dB LAeq, 8 hour	Night-time dB LAmax
10	Bedroom 1	31	27	44
	Lounge	35	n/a	n/a
11	Bedroom 1	31	26	45
	Lounge	34	n/a	n/a
12	Studio	30	25	45
13	Bedroom 1	31	27	44
	Lounge	35	n/a	n/a
14	Studio	31	26	45
15	Studio	30	25	45

Table 11 Resultant internal noise levels

As shown in the table above, the internal noise levels with the specifications presented within this report would be within the recommended internal noise level of BS 8233:2014 and the LAmax recommendation as per ProPG and WHO guidelines. Full calculations are shown in Appendix C.

8 PLANT NOISE EMISSION LIMITS

Due to the variations in the representative background noise levels across the site, noise emission limits for new plant and equipment would depend on the proposed installation location of the plant.

Typically, we would expect that new plant installations are 10dB below the background noise level to ensure a low likelihood of adverse impact.

Therefore, a range of levels have been provided as noise limits for external plant until specific plant and installations locations are known:

Period	Minimum Background Sound Level dB L _{A90}	Maximum plant noise rating level dB L _{Ar,Tr}
Daytime (07:00-23:00)	48 - 53	38 - 43
Night-time (23:00-07:00)	42 - 43	32 - 33

Table 12 Noise limits for external plant

Plant noise emission limits apply to the cumulative noise level from all proposed items of plant operating at their standard duty and are applicable at 1 metre from the window of the nearest noise sensitive receptors.

At this point in the design, the exact details of the proposed units and proposed installation locations are unknown. When detailed information regarding new plant and equipment is available, a more detailed noise assessment should be undertaken based on the specific plant to be installed, its location and acoustic feature corrections. Note that suitable attenuation measures should be specified (e.g. acoustic screening or acoustic attenuators) where required to comply with these noise emission limits.

Please note that plant noise limits are in terms of 'rating level' as defined in BS 4142:2014+A1:2019. Therefore, if acoustic features, such as tones, impulsivity or intermittence are present a correction will need to be applied and the actual 'specific noise level' produced by any plant / equipment will need to be lower than the values above.

9 CONCLUSION

An environmental noise survey has been undertaken at the site of the Proposed Development at 200-202 Broad Street, Reading, RG1 7QJ.

Based on the results of the noise survey, a noise impact assessment considering relevant planning policy and guidance has been undertaken.

This assessment has concluded that significant adverse effects are unlikely to occur at the proposed residential development if appropriate mitigation measures are implemented, which are detailed within this report.

It is therefore considered that the site is appropriate for residential development.

ACOUSTIC TERMINOLOGY

Decibel scale - dB

The decibel (dB) is a relative unit of measurement used in acoustics. The dB is a logarithmic ratio between a measured level and a reference level of 0 dB (i.e the threshold of human hearing). Simply put, the decibel compresses the wide range of sounds we hear into more manageable numbers.

Addition of noise from several sources

Sound produced by multiple sound sources are added logarithmically e.g. power ratio of 2 = 3dB, power ratio of 10 = 10dB. Therefore, two equally intense sound sources operating simultaneously produce a sound level which is 3dB higher than a single source e.g. 60dB + 60dB = 63dB.

Subjective impression of noise

Human response to sound is highly individualized and often based on psychological factors such as emotion and expectation. Sensitivity to sound typically depends on the loudness, pitch, duration of the occurrence, and time of occurrence (e.g. a sound source could cause annoyance during the night where it would not during the day). The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level	Change in perceived loudness
1 dB	Imperceptible
3 dB	Just barely perceptible
6 dB	Clearly noticeable
10 dB	About twice as loud

'A' Weighted Frequency Filter - dB(A)

The human ear is not equally sensitive in all frequencies. The A-weighting filter was devised to take this into account when undertaking noise measurements and allows a sound level meter to replicate the human ears response to sound.

$L_{Aeq, T}$

Sound can fluctuate widely over a given period. L_{Aeq} is the A-weighted equivalent continuous sound level, with T denoting the time period over which the fluctuating sound levels were averaged e.g. $L_{Aeq, 16h}$ is the equivalent continuous noise level over an 16 hour period.

L_{A90}

A-weighted sound level exceeded for 90% of the measurement period, calculated via statistical analysis. The L_{A90} descriptor is typically used to establish background sound levels for noise impact assessments

L_{A10}

A-weighted sound level exceeded for 10% of the measurement period, calculated via statistical analysis.

L_{AFmax}

A-weighted sound level maximum sound pressure level that has been measured over a given time period

ACOUSTIC TERMINOLOGY

Octave Bands

The audio or frequency spectrum of the human ear is in the range of 20Hz to 20 kHz. The spectrum tells how the energy of the sound signal is distributed in frequency. Octave bands divides the audio spectrum into 10 equal parts. The International Standards Organisation defines the centre frequency of these bands as 31.5Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1kHz, 2kHz, 4kHz, 8kHz and 16kHz.

Noise Rating (NR) Curves

A method of rating noise using a set of curves relating octave band sound pressure levels. Typically used for building services systems within offices

Airborne sound

Sound radiated from a source into the surrounding air e.g. musical instruments, tv/radio, machinery/equipment. Airborne sound insulation refers to the reduction or attenuation of airborne sound, usually via a solid partition between a source and receiver.

Impact sound

Sound resulting from the impact between colliding objects, e.g. footfall impact upon a floor. Impact sound insulation refers to the resistance of a floor to the transmission of impact sound, typically via the installation of a 'resilient layer'

Flanking sound

The transmission of airborne sound between two adjacent rooms by paths other than via the separating partition between the rooms, e.g. the abutment point of a wall and floor.

Structure-borne noise

Noise caused by the vibration of elements of a structure. This can result in reradiated noise, whereby the vibrating element transmits airborne sound into a space e.g. vibration caused by mechanical plant installed within a plant room which is not adequately isolated from the structure, or construction/demolition work in an adjacent building.

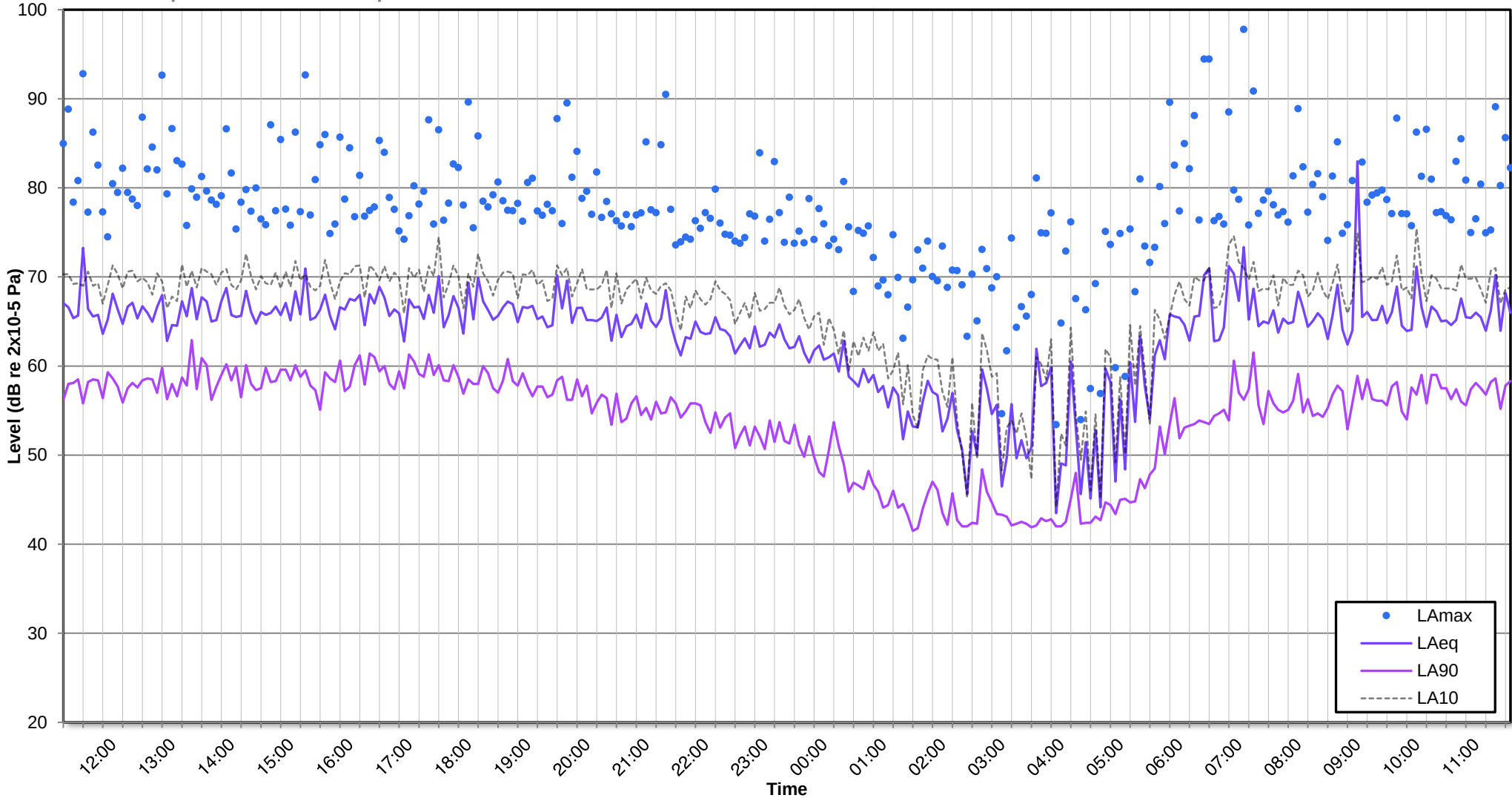
Reverberant sound

Sound in an enclosed space (usually a room), which results from repeated reflections at the boundaries. Reverberation time is the time taken for a steady sound level in an enclosed space to decay by 60dB, measured from the moment the sound source is switched off. A example of a typically reverberant space would be a classic church. Absorptive materials can be used to reduce reflections and reverberation times.

APPENDIX B1

ENVIRONMENTAL NOISE TIME HISTORY

20418.NIA-RPT.01
Noise Monitoring Position 1
11:15 on 19th April to 11:40 on 20th April 2023



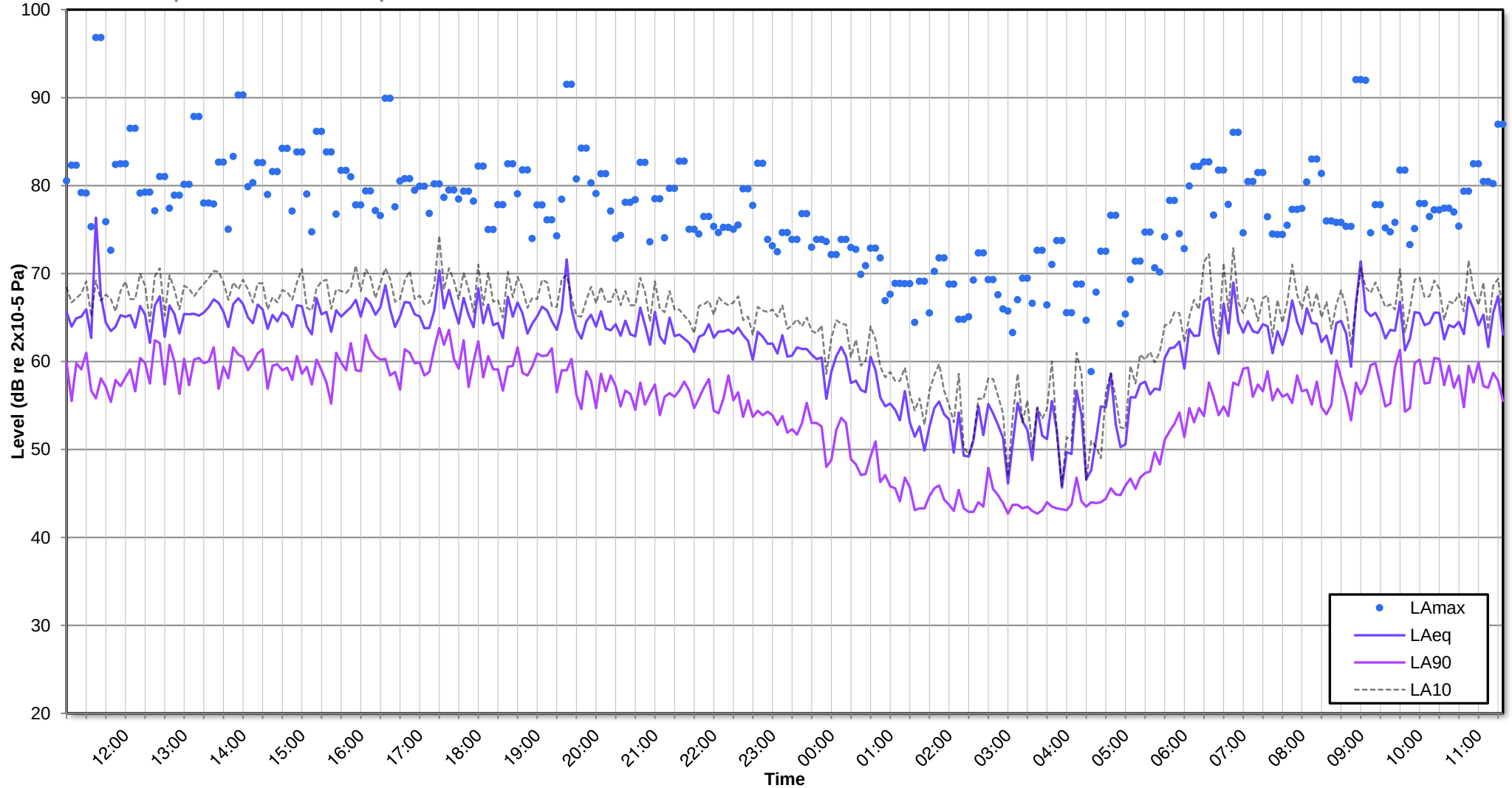
APPENDIX B2

ENVIRONMENTAL NOISE TIME HISTORY

20418.NIA-RPT.01

Noise Monitoring Position 2

11:05 on 19th April to 11:35 on 20th April 2023



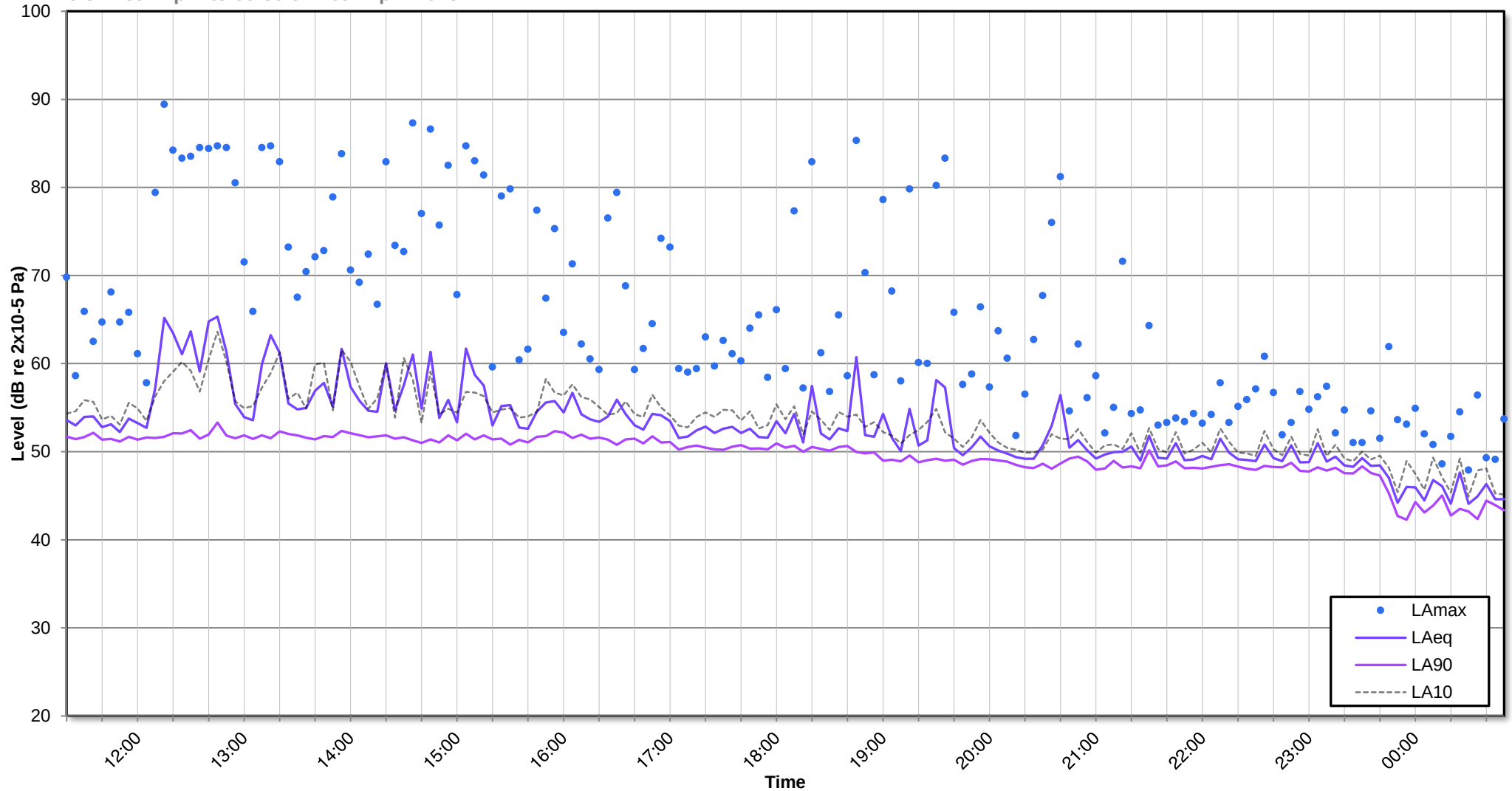
APPENDIX B3

ENVIRONMENTAL NOISE TIME HISTORY

20418.NIA-RPT.01

Noise Monitoring Position 3

11:20 on 19th April to 00:50 on 20th April 2023



APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:

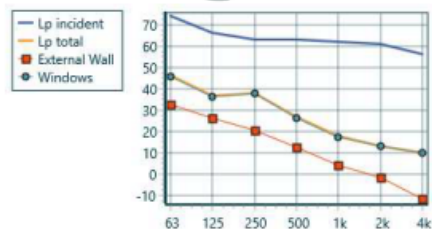
Job No.:

Initials:chunc

Date:20/04/2023

File Name:Flat 10, Bedroom 1, Daytime.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	66.0	63.0	63.0	62.0	61.0	56.0	67
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	16
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [6.6 m²]	8	8	8	8	8	8	8	
Element sound level contribution	32	26	20	12	4	-2	-12	
Element 2 , STL	-25	-26	-22	-33	-41	-45	-43	31
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.4 m²]	5	5	5	5	5	5	5	
Element sound level contribution	46	36	38	26	17	13	10	
Receiver								
Room volume(-10LogV) [38 m3]	-16	-16	-16	-16	-16	-16	-16	31
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	46	37	38	27	18	13	10	
Level difference								
D2m,nT	30	31	27	39	47	50	48	35

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:

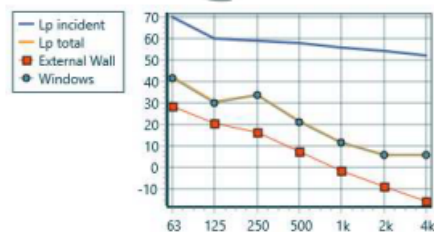
Job No.:

Initials:chunc

Date:20/04/2023

File Name:Flat 10, Bedroom 1, Night.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	70.0	60.0	59.0	58.0	56.0	54.0	52.0	61
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	11
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [6.6 m²]	8	8	8	8	8	8	8	
Element sound level contribution	28	20	16	7	-2	-9	-16	
Element 2 , STL	-25	-26	-22	-33	-41	-45	-43	27
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.4 m²]	5	5	5	5	5	5	5	
Element sound level contribution	42	30	34	21	11	6	6	
Receiver								
Room volume(-10LogV) [38 m3]	-16	-16	-16	-16	-16	-16	-16	27
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	42	31	34	22	12	6	6	
Level difference								
D2m,nT	30	31	27	39	47	50	48	33
LpAinc - LpARev,T0								

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:

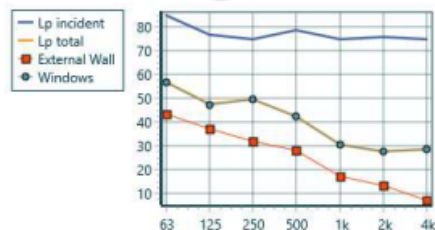
Job No.:

Initials:chunc

Date:20/04/2023

File Name:Flat 10, Bedroom 1, Night LAmaz.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	85.0	77.0	75.0	79.0	75.0	76.0	75.0	82
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	29
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [6.6 m²]	8	8	8	8	8	8	8	
Element sound level contribution	43	37	32	28	17	13	7	
Element 2 , STL	-25	-26	-22	-33	-41	-45	-43	44
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.4 m²]	5	5	5	5	5	5	5	
Element sound level contribution	57	47	50	42	30	28	29	
Receiver								
Room volume(-10LogV) [38 m3]	-16	-16	-16	-16	-16	-16	-16	44
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	57	48	50	43	31	28	29	
Level difference								
D2m,nT	30	31	27	39	47	50	48	LpAinc - LpARev,T0 37

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

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Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

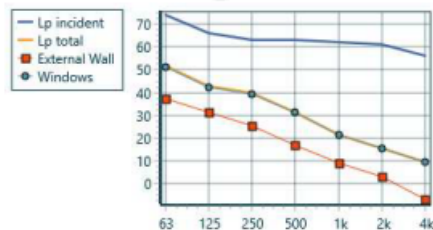
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 10, Lounge, Daytime.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	66.0	63.0	63.0	62.0	61.0	56.0	67
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	21
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [17 m²]	12	12	12	12	12	12	12	
Element sound level contribution	37	31	25	17	9	3	-7	
Element 2 , STL	-24	-25	-25	-33	-42	-47	-48	35
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [8.8 m²]	9	9	9	9	9	9	9	
Element sound level contribution	51	42	39	31	21	15	9	
Receiver								
Room volume(-10LogV) [63 m3]	-18	-18	-18	-18	-18	-18	-18	35
Reverberation time (s)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
RT (+10LogT)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	52	43	40	32	22	16	10	
Level difference								
D2m,nT	28	28	29	37	46	51	52	34

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

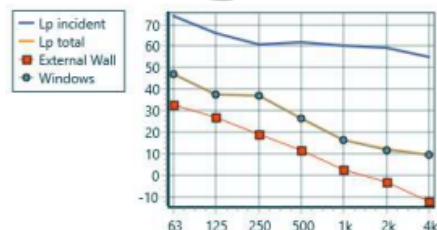
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 11, Bedroom 1, Daytime.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	66.0	61.0	62.0	60.0	59.0	55.0	65
Path								
Element 1, STL	-41	-39	-42	-50	-57	-62	-67	16
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [7.1 m²]	9	9	9	9	9	9	9	
Element sound level contribution	33	27	19	12	3	-3	-12	
Element 2, STL	-25	-26	-22	-33	-41	-45	-43	31
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.1 m²]	6	6	6	6	6	6	6	
Element sound level contribution	47	37	37	26	16	12	10	
Receiver								
Room volume(-10LogV) [37 m3]	-16	-16	-16	-16	-16	-16	-16	31
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	47	38	37	27	17	12	10	
Level difference								
D2m,nT	29	31	26	38	46	49	47	LpAinc - LpARev,T0
								34

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

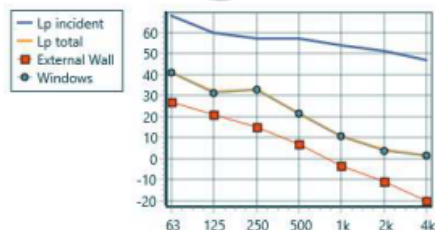
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 11, Bedroom 1, Night.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	68.0	60.0	57.0	57.0	54.0	51.0	47.0	59
Path								
Element 1, STL	-41	-39	-42	-50	-57	-62	-67	11
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [7.1 m²]	9	9	9	9	9	9	9	
Element sound level contribution	27	21	15	7	-3	-11	-20	
Element 2, STL	-25	-26	-22	-33	-41	-45	-43	26
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.1 m²]	6	6	6	6	6	6	6	
Element sound level contribution	41	31	33	21	10	4	2	
Receiver								
Room volume(-10LogV) [37 m3]	-16	-16	-16	-16	-16	-16	-16	26
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	41	32	33	22	11	4	2	
Level difference								
D2m,nT	29	31	26	38	46	49	47	32

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

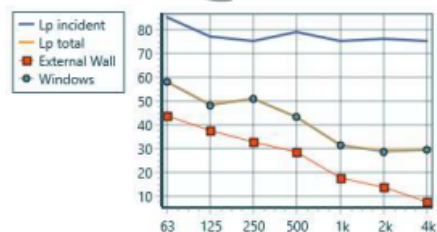
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 11, Bedroom 1, Night LMax.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	85.0	77.0	75.0	79.0	75.0	76.0	75.0	82
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	30
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [7.1 m²]	9	9	9	9	9	9	9	
Element sound level contribution	44	38	33	29	18	14	8	
Element 2 , STL	-25	-26	-22	-33	-41	-45	-43	45
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.1 m²]	6	6	6	6	6	6	6	
Element sound level contribution	58	48	51	43	31	29	30	
Receiver								
Room volume(-10LogV) [37 m3]	-16	-16	-16	-16	-16	-16	-16	45
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	58	49	51	44	32	29	30	
Level difference								
D2m,nT	29	31	26	38	46	49	47	36

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

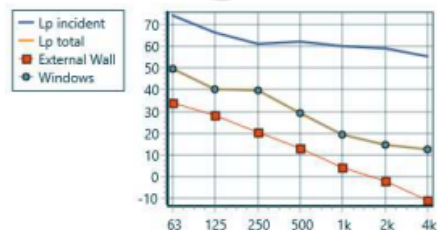
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 11, Lounge, Daytime.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	66.0	61.0	62.0	60.0	59.0	55.0	65
Path								
Element 1, STL	-41	-39	-42	-50	-57	-62	-67	17
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [5.8 m²]	8	8	8	8	8	8	8	
Element sound level contribution	34	28	20	13	4	-2	-11	
Element 2, STL	-25	-26	-22	-33	-41	-45	-43	34
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.8 m²]	7	7	7	7	7	7	7	
Element sound level contribution	50	40	40	29	19	15	13	
Receiver								
Room volume(-10LogV) [44 m3]	-16	-16	-16	-16	-16	-16	-16	34
Reverberation time (s)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
RT (+10LogT)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	50	40	40	29	19	15	13	
Level difference								
D2m,nT	29	31	26	38	46	49	48	34
								LpAinc - LpARev,T0

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:

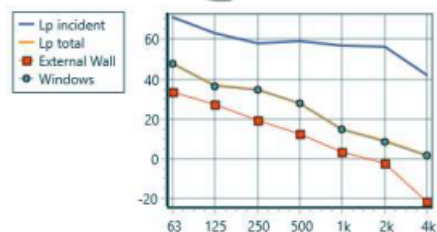
Job No.:

Initials:chunc

Date:21/04/2023

File Name:Flat 12 Studio, Daytime.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	71.0	63.0	58.0	59.0	57.0	56.0	42.0	62
Path								
Element 1, STL	-41	-39	-42	-50	-57	-62	-67	16
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [23 m²]	14	14	14	14	14	14	14	
Element sound level contribution	34	28	20	13	4	-2	-21	
Element 2, STL	-20	-23	-20	-28	-39	-44	-37	30
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.8 m²]	7	7	7	7	7	7	7	
Element sound level contribution	48	37	35	28	15	9	2	
Receiver								
Room volume(-10LogV) [76 m3]	-19	-19	-19	-19	-19	-19	-19	30
Reverberation time (s)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
RT (+10LogT)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	48	37	35	28	15	9	2	
Level difference								
D2m,nT	27	30	27	35	46	51	44	LpAinc - LpARev,T0
								33

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:

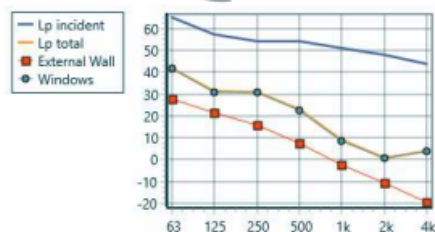
Job No.:

Initials:chunc

Date:21/04/2023

File Name:Flat 12 Studio, Night.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	65.0	57.0	54.0	54.0	51.0	48.0	44.0	56
Path								
Element 1, STL	-41	-39	-42	-50	-57	-62	-67	11
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [23 m²]	14	14	14	14	14	14	14	
Element sound level contribution	28	22	16	8	-2	-10	-19	
Element 2, STL	-20	-23	-20	-28	-39	-44	-37	25
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.8 m²]	7	7	7	7	7	7	7	
Element sound level contribution	42	31	31	23	9	1	4	
Receiver								
Room volume(-10LogV) [76 m3]	-19	-19	-19	-19	-19	-19	-19	25
Reverberation time (s)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
RT (+10LogT)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	42	31	31	23	9	1	4	
Level difference								
D2m,nT	27	30	27	35	46	51	44	32

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

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Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

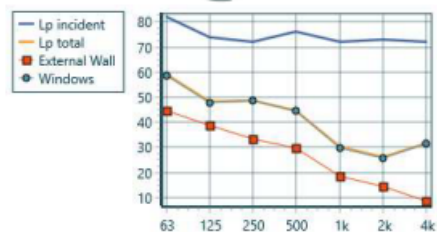
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 12 Studio, Night LAmaz.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	82.0	74.0	72.0	76.0	72.0	73.0	72.0	79
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	30
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [23 m²]	14	14	14	14	14	14	14	
Element sound level contribution	45	39	34	30	19	15	9	
Element 2 , STL	-20	-23	-20	-28	-39	-44	-37	45
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.8 m²]	7	7	7	7	7	7	7	
Element sound level contribution	59	48	49	45	30	26	32	
Receiver								
Room volume(-10LogV) [76 m3]	-19	-19	-19	-19	-19	-19	-19	45
Reverberation time (s)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
RT (+10LogT)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	59	48	49	45	30	26	32	
Level difference								
D2m,nT	27	30	27	35	46	51	44	35

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

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Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

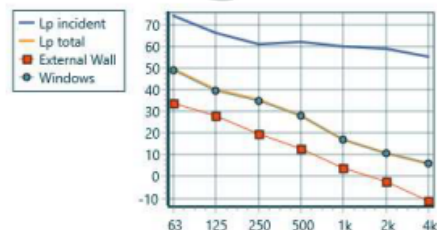
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 14 Studio, Daytime.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	66.0	61.0	62.0	60.0	59.0	55.0	65
Path								
Element 1, STL	-41	-39	-42	-50	-57	-62	-67	17
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [14 m²]	11	11	11	11	11	11	11	
Element sound level contribution	34	28	20	13	4	-2	-11	
Element 2, STL	-24	-25	-25	-33	-42	-47	-48	31
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [8.8 m²]	9	9	9	9	9	9	9	
Element sound level contribution	49	40	35	28	17	11	6	
Receiver								
Room volume(-10LogV) [85 m3]	-19	-19	-19	-19	-19	-19	-19	31
Reverberation time (s)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
RT (+10LogT)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	49	40	35	28	17	11	6	
Level difference								
D2m,nT	29	30	30	38	47	52	53	LpAinc - LpARev,T0 35

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

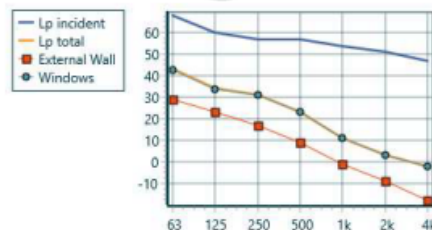
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 14 Studio, Night.inz

Comment:



Octave Band Centre Frequency (Hz)							
Source	63	125	250	500	1k	2k	4k
Incident sound level (freefield)	68.0	60.0	57.0	57.0	54.0	51.0	47.0
Overall dBA							
59							
Path							
Element 1, STL	-41	-39	-42	-50	-57	-62	-67
Facade Shape factor Level diff.	0	0	0	0	0	0	0
Insertion Loss	0	0	0	0	0	0	0
Area(+10LogA) [14 m ²]	11	11	11	11	11	11	11
Element sound level contribution	29	23	17	9	-1	-9	-18
13							
Element 2, STL	-24	-25	-25	-33	-42	-47	-48
Facade Shape factor Level diff.	0	0	0	0	0	0	0
Insertion Loss	0	0	0	0	0	0	0
Area(+10LogA) [8.8 m ²]	9	9	9	9	9	9	9
Element sound level contribution	43	34	31	23	11	3	-2
26							
Receiver							
Room volume(-10LogV) [85 m ³]	-19	-19	-19	-19	-19	-19	-19
Reverberation time (s)	0.6	0.6	0.6	0.6	0.6	0.6	0.6
RT (+10LogT)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Equation Constant	11	11	11	11	11	11	11
Room sound level	43	34	31	23	11	3	-2
26							
Level difference							
D2m,nT	29	30	30	38	47	52	53
LpAinc - LpARev,T0							
34							

** Element descriptions:

#1: External Wall
#2: Windows

APPENDIX C

EXTERNAL BUILDING FABRIC CALCULATIONS

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name: 200-202 Broad Street, Reading

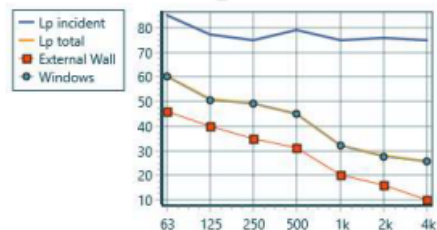
Job No.: 20418

Initials: Daniel Green MIOA

Date: 20/04/2023

File Name: Flat 14 Studio, Night LAmaz.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	85.0	77.0	75.0	79.0	75.0	76.0	75.0	82
Path								
Element 1 , STL	-41	-39	-42	-50	-57	-62	-67	32
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [14 m²]	11	11	11	11	11	11	11	
Element sound level contribution	46	40	35	31	20	16	10	
Element 2 , STL	-24	-25	-25	-33	-42	-47	-48	45
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [8.8 m²]	9	9	9	9	9	9	9	
Element sound level contribution	60	51	49	45	32	28	26	
Receiver								
Room volume(-10LogV) [85 m3]	-19	-19	-19	-19	-19	-19	-19	45
Reverberation time (s)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
RT (+10LogT)	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	60	51	49	45	32	28	26	
Level difference								
D2m,nT	29	30	30	38	47	52	53	LpAinc - LpArev,T0 38

** Element descriptions:

#1: External Wall
#2: Windows