

Noise impact assessment of a proposed residential development

Lake 62, Cotswold Water Park, Ashton Keynes



Client: Quinque Stella Holdings Limited

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0. SUMMARY

- 0.1. ACA Acoustics Limited has been commissioned to assess external noise intrusion to a proposed new residential development of holiday homes at Lake 62, Cotswold Water Park, Ashton Keynes. The assessment has been prepared to support a planning application to the Local Planning Authority, Wiltshire Council.
- 0.2. A sound level survey has been carried out between 2nd – 5th April 2024. Whilst on site ACA Acoustics' consultant considered the sound climate primarily consists of traffic noise from nearby routes. Noise emissions from activity within the Aggregate Industries site itself was subjectively inaudible at all times during the sound level survey,
- 0.3. Based on the sound level survey, a 3D noise map of the site has been created to calculate levels from the measurement position to where the proposed dwellings are located, based on this sound levels used in the assessment for the different areas of acoustic climate identified around the lake are as shown in Table 1 below.

Location	Daytime (07:00 – 23:00) LAeq	Night-Time (23:00 – 07:00) LAeq	Night-Time (23:00 – 07:00) Typical LAfmax
West of the site	51 dB	47 dB	64 dB
South of the site	53 dB	48 dB	68 dB
East of the site	53 dB	44 dB	70 dB

Table 1: Summary sound level results at dwellings through iNoise model

- 0.4. The impact of industrial and commercial noise sources has also been assessed in accordance with BS 4142:2014+A1:2019. This indicates that without mitigation there a low likelihood of adverse impacts on future residents. An acoustic mitigation scheme has been proposed to mitigate these impacts. An internal sound level criteria 5dB lower than that proposed in BS 8233:2014 has been adopted to account for any residual impact remaining to ensure the amenity of future occupants is not reduced.
- 0.5. A Stage 1: Initial Site Noise Risk Assessment, in accordance with ProPG Planning & Noise, identifies the site as being in an area with a low/medium noise risk, and therefore an Acoustic Design Statement has been prepared.
- 0.6. A Stage 2 detailed acoustic design process has been followed, in accordance with ProPG. Details of the Acoustic Design Statement are included in this report.

- 0.7. A scheme for sound insulation of the building envelope has been developed such that internal sound levels meet the guideline limits for a good standard of amenity to living rooms and bedrooms set out in ProPG and BS 8233:2014. Details of the sound insulation scheme are provided within this report.
- 0.8. In conclusion, it is recommended that the site is suitable for residential development, subject to implementation of the specified scheme of façade sound insulation.

1. INTRODUCTION

ACA Acoustics Limited has been commissioned by Quinque Stella Holdings Limited to carry out a survey and assessment of external sound levels to a proposed residential development of holiday homes at Lake 62, Cotswold Water Park, Ashton Keynes, and, where necessary, to make recommendations for a suitable sound mitigation scheme.

The objective of the assessment is to determine the impact that existing noise sources would have on the proposed residential units in accordance with ProPG: Planning & Noise, national planning policies and other relevant British Standards and guidance documents. The proposed development does not include private external amenity areas, however in accordance with the Planning Practice Guidance - Noise, consideration has also been given to the availability of nearby publicly accessible external amenity areas.

This report presents results of the sound level survey, along with ProPG Stage 1 and Stage 2 assessments.

2. ACOUSTIC CRITERIA

2.1. National Planning Policy Framework (NPPF) and Noise Policy Statement for England (NPSE)

The National Planning Policy Framework (referred to as NPPF) sets out the Government's planning policies for England and provides guidance on how these are expected to be applied, providing a framework within which Local Authorities can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Paragraph 187 of the NPPF states that,

"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".

Paragraph 198 also talks specifically about noise and advises,

"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:

- *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 quality of life.*
- *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”*

The Government’s long-term policy aims relating to noise are contained in the Noise Policy Statement for England (referred to as NPSE). Stated aims of the NPSE are:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy of 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.”*

Paragraphs 2.19 to 2.24 clarify the above aims, referring to established concepts from toxicology; NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level). It also introduces a new concept relating to “significant adverse” of SOAEL (Significant Observed Adverse Effect Level), however noting,

“It is not possible to have a single objective noise-based measure that describes 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”.

The first aim of NPPF Paragraph 198 and the second underlying aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development, as set out in the NPPF. As neither the NPPF nor NPSE includes any numerical criteria, it is necessary to consider guidance provided in other documents to determine suitable limits that would define the LOAEL on an individual basis.

Finally, it is also of benefit to consider Paragraph 2.7, which advises that,

“... the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications”.

This provides clear guidance that noise must not be considered in isolation but as part of the overall scheme taking into account the overall sustainability and associated impacts of the proposed development; there is no benefit in reducing noise to an excessively low level if this creates or increases some other adverse impact. Similarly, it may be appropriate in some cases for noise to

have an adverse impact if this is outweighed by the reduction or removal of some other adverse impact that is of greater significance to the development.

2.2. Planning Practice Guidance – Noise (PPG-N)

Related to the NPSE and the NPPF, The Department for Communities and Local Government has published additional guidance and clarifications within the Planning Practice Guidance – Noise (PPG-N), available at <https://www.gov.uk/guidance/noise--2>.

Paragraph 003 of the PPG advises that:

“Plan-making and decision making need to take account of the acoustic environment and in doing so consider:

- *Whether or not a significant adverse effect is occurring or likely to occur;*
- *Whether or not an adverse effect is occurring or likely to occur; and*
- *Whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure ... is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.”

This guidance is like that set out in the NPPF and NPSE, however, Paragraph 005 of the PPG-N provides outline guidance of the definition of “significant adverse” and “adverse” effects. A copy of the table appended to Paragraph 005 is repeated below.

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
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
Lowest Observed Adverse Effect Level			
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 and reduce to a minimum
Significant Observed Adverse Effect Level			
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

Figure 1: Noise exposure hierarchy, taken from Planning Practice Guidance – Noise

Although this table provides descriptions of definitions for the NOEL, LOAEL and SOAEL, as with the NPPF and NPSE there are no numerical values provided.

Paragraph 011 of the PPG-N also provides examples where the noise impact may be offset, including through the use of local amenity areas, noting:

“Noise impacts may be partially offset if residents have access to one or more of:

- *a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling;*
- *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;*
- *a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance)."*

Occupants of the holiday homes will have access to areas of greenery around the lake.

2.3. ProPG: Planning & Noise

ProPG: Planning & Noise is a collaborative document prepared by the Institute of Acoustics, Association of Noise Consultants, and the Chartered Institute of Environmental Health.

The document brings together guidance and recommendations in assessing the noise impact on new residential developments from various documents including the NPPF, NPSE, PPG-N, BS 8233:2014 and the World Health Organisation guidance. The aim is to regularise the assessment process and to encourage good acoustic design for new noise-sensitive developments.

The assessment process is split into two sequential stages:

- Stage 1 – An initial noise risk assessment of the proposed development site; and
- Stage 2 – A systematic consideration of four key elements:
 - Element 1 – Demonstrating a “Good Acoustic Design Process”;
 - Element 2 – Observing internal “Noise Level Guidelines”;
 - Element 3 – Undertaking an “External Amenity Area Noise Assessment”; and
 - Element 4 – Consideration of “Other Relevant Issues”.

The Stage 1 risk assessment requires sound levels to be measured at the site over daytime and night-time periods and, if necessary, any anticipated significant changes to the climate to be predicted to determine a “‘typical worst case’ 24-hour day either now or in the foreseeable future”.

The assessment should include all relevant sources of transport noise that affect the site, (including road, railway, and aircraft sources). It may also include industrial and commercial noise, where this is present but not dominant.

The measured/calculated daytime LAeq, 16-hour and night-time LAeq, 8-hour sound levels are then compared with Figure 1 of ProPG to complete the site’s initial noise risk assessment. Copy of Figure 1 from ProPG is included in Figure 2 below.

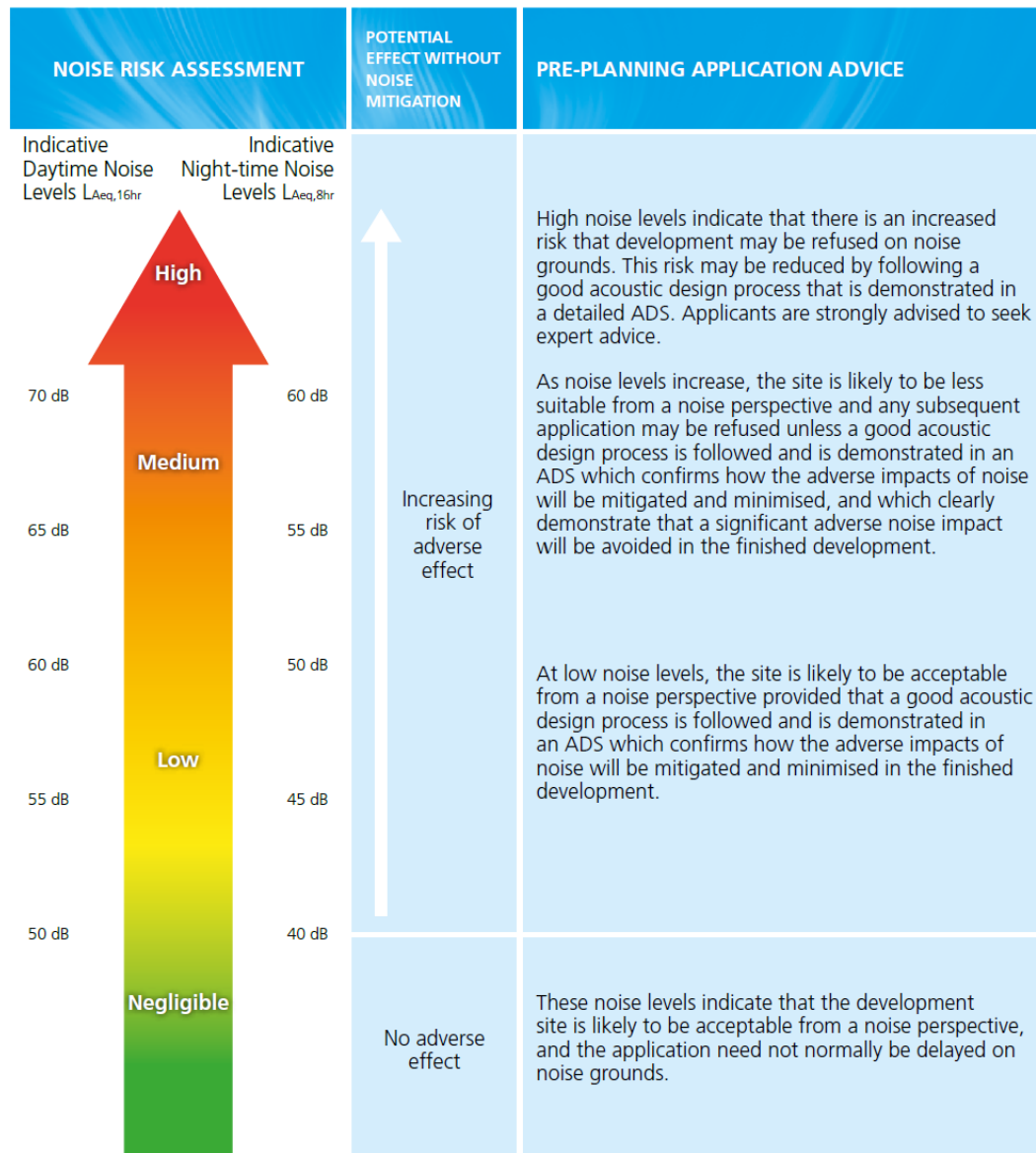


Figure 1 Notes:

- 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 $L_{Amax,F} > 60$ dB means the site should not be regarded as negligible risk.

Figure 2: Noise Risk Assessment, taken from Figure 1 of ProPG Planning & Noise

The outcome of the Stage 1 initial risk assessment determines the next step and whether an Acoustic Design Statement is necessary. It is of benefit to note guidance in Paragraph 2.10 of ProPG:

“The indicative noise levels are intended to provide a sense of the noise challenge at a potential residential development site and should be interpreted flexibly having regard to the locality, the project and the wider context.”

A site being placed in the High-Risk category is not necessarily an indication that the development should be refused, but rather should be viewed taking into account the context of the development and highlights the importance of following a good acoustic design process from an early stage.

Element 2 of the Stage 2 assessment provides recommended internal sound levels to the residential dwellings. Criteria are taken from BS 8233:2014 with an additional criterion for individual short-term sound levels at night (LAfmax) and various clarifications and notes. These include an expansion on advice relating to the potential relaxation of the internal sound levels which is often overlooked when considering BS 8233:2014.

Paragraphs 2.33 to 2.36 discuss the impact of ventilation and opening windows. It is clearly stated that:

“Most residents value the ability to open windows at will, for a variety of reasons, and LPAs should therefore normally request that designers principally aim, through the use of good acoustic design, to achieve the internal noise level guidelines in noise-sensitive rooms with windows open”.

However, Paragraph 2.33 confirms that an open window typically reduces the sound insulation performance of the façade to 10 to 15dBA. This means that any site with a noise risk assessment above “Negligible” would fail to achieve the internal sound level criteria with windows open. Paragraph 2.34 acknowledges this, confirming that internal sound levels for sites in urban areas and adjacent to transportation noise sources may only be practically achieved with windows closed.

“In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide “whole dwelling ventilation” in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position. Furthermore, in this scenario the internal LAeq target noise levels should not generally be exceeded.”

Copy of Figure 2 of ProPG is included in Figure 3 below.

ACTIVITY	LOCATION	07:00 – 23:00 HRS	23:00 – 07:00 HRS
Resting	Living room	35 dB $L_{Aeq,16\text{ hr}}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16\text{ hr}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hr}}$	30 dB $L_{Aeq,8\text{ hr}}$ 45 dB $L_{Amax,F}$ (Note 4)

NOTE 1 The Table provides recommended *internal* L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The *internal* L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the *internal* L_{Aeq} target levels recommended in the Table.

NOTE 3 These *internal* L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (see Section 3.D).

Figure 3: Internal sound level guidelines, taken from Figure 2 of ProPG: Planning & Noise

Sound levels in external amenity areas are considered in Element 3 of the Stage 2 assessment. This requires that, where practical, sound levels in amenity areas that are an intrinsic part of the overall design, should ideally not be above the range $L_{Aeq,16\text{-hour}}$ 50dB to 55dB. It does however quote BS 8233:2014, that:

"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these amenity spaces but should not be prohibited."

2.4. The Building Regulations Approved Document O

Although not applicable to planning matters, it is beneficial to consider the impact of how complying with The Building Regulations Approved Document O will affect the ventilation strategy.

Requirement O1 of Schedule 1 to The Building Regulations 2010 requires that the following is met.

Requirement	
Requirement	Limits on application
O1 Overheating mitigation	
(1) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to—	
(a) limit unwanted solar gains in summer;	
(b) provide an adequate means to remove heat from the indoor environment.	
(2) In meeting the obligations in paragraph (1)—	
(a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and	
(b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.	

Figure 4: Requirement O1 of The Building Regulations 2010

The aim of Requirement O1 is to protect the health and welfare of the occupants of residential buildings, by reducing the occurrence of high indoor temperatures.

Where practical, this should be achieved through limiting solar gains through the design of the building and façade elements. Excess heat should then be removed through opening windows, ventilation louvres in external walls, a mechanical ventilation system, or a mechanical cooling system. Paragraph 2.11 of Approved Document O confirms that *"The building should be constructed to meet requirement O1 using passive means as far as reasonably practicable"*.

However, requirement O1(2)(a) requires that any successful overheating mitigation strategy must also consider other potential adverse impacts, including sound levels inside bedrooms at night.

Paragraphs 3.2 and 3.3 consider the impact of noise on the overheating strategy. These have been included below.

"3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am)."

- 3.3 *Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.*
- a. *40dB LAeq, T averaged over 8 hours (between 11pm and 7am).*
 - b. *55dB LAfmax more than 10 times a night (between 11pm and 7am)."*

The Institute of Acoustics and Association of Noise Consultants have issued guidance on complying with the requirements of Approved Document O. They recommend that a 9dB open window loss is suitable for most areas.

On this basis, where sound levels incident on a bedroom window do not exceed LAeq, 8-hour 49dB and LAfmax 64dB more than 10 times per night, then the criteria in paragraph 3.3 of Approved Document O should be achieved and an overheating mitigation strategy allowing for open windows is appropriate. When external sound levels exceed these levels then it is likely windows will be closed by occupants overnight and an alternative strategy is required.

Note that this does not mean that windows should be sealed closed as most residents value the choice of whether to open windows or not. For example, a resident may choose to open windows to a bedroom to help mitigate overheating to the property whilst the bedroom is not in use during the daytime, then close the windows when sleeping in the bedroom overnight.

In accordance with The Building Regulations Approved Document F, it is recommended that if continuous mechanical ventilation is used, sound levels in bedrooms overnight should not exceed a level of LAeq 30dB when the system is operating at its minimum low rate. Although, evidence referenced in The Association of Noise Consultants' *Acoustics Ventilation and Overheating: Residential Design Guide*, notes that "*a more prudent limit for mechanical services noise around 24-26dBA is likely to be required to prevent an adverse reaction from most occupants while falling asleep*".

2.5. British Standard 8233:2014

The introduction to BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* advises that "*this guide suggests criteria, such as suitable sleeping/resting conditions, and proposes noise levels that normally satisfy these criteria*". As such it is considered that guideline noise limits set out in BS 8233:2014 are suitable to protect future occupants of the dwelling from noise disturbance and compliance with these values would ensure sound levels within the new development are below the Lowest Observed Adverse Effect Level and comply with the principles of the NPPF, NPSE and PPG-N, along with corresponding to the recommended criteria provided by the Local Authority.

Guidance limits for internal sound levels within living rooms and bedrooms, taken from Table 4 of BS 8233:2014, are shown in Table 2 below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35dB LAeq, 16hr	-
Dining	Dining Room/Area	40dB LAeq, 16hr	-
Sleeping (daytime resting)	Bedroom	35dB LAeq, 16hr	30dB LAeq, 8hr *

Table 2: BS 8233:2014 indoor ambient sound levels for dwellings

The above criteria are generally considered suitable for noise from traffic and other ‘anonymous’ sources. The accompanying notes to Table 4 in BS 8233:2014 confirm that the levels can be relaxed by 5dB and still achieve reasonable criteria.

In order to account for the industrial and commercial sources near the development site, ACA Acoustics have applied an internal criteria 5dB lower than the BS 8233 guideline values to ensure the amenity of future occupants is robustly preserved. As a result, internal ambient sound levels targeted within this assessment are LAeq 30dB during the day and LAeq 25dB overnight. This will ensure a good level of amenity to occupants.

2.4 British Standard 4142:2014+A1:2019

The scope of BS 4142:2014+A1:2019 advises,

“This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature ... to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident”.

The assessment method of BS 4142:2014+A1:2019 corrects the specific sound level from the source under investigation to account for characteristics that could make the sound more obtrusive to obtain a rating level. This rating level is compared against the prevailing background noise outside the noise-sensitive property. Section 11 of BS 4142:2014+A1:2019 provides a commentary of the assessment result, to,

“Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9).

- Typically, the greater this difference, the greater the magnitude of the impact;*
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context;*
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.*

Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

It is important to consider however, that BS 4142:2014+A1:2019 specifically confirms that this commentary provides only an initial indicative conclusion and is dependent on the context of the assessment, which may materially alter the assessment result.

Section 11 discusses factors which should be taken into consideration when reviewing the context. These include,

“The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- i) Façade insulation treatment;*
- ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- iii) Acoustic screening”.*

This confirms that a good standard of façade sound insulation and a ventilation scheme allowing residents to achieve appropriate levels of ventilation without having to open windows would mitigate potential adverse impacts identified by the BS 4142 assessment. Discussion of pertinent factors associated with this development are included in this report.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

The site is at Lake 62, Cotswold Water Park, Ashton Keynes. The site is comprised primarily of a large lake, with busy roads to the south and east, with an industrial facility to the northeast of the site, and fields to the north and west. Sound levels from nearby road traffic activity is dominant in the vicinity and sound levels from the Aggregate Industries industrial site are subjectively inaudible at the closest proposed habitable property.

A site location plan showing the proposed development location is included in Figure 5 below.

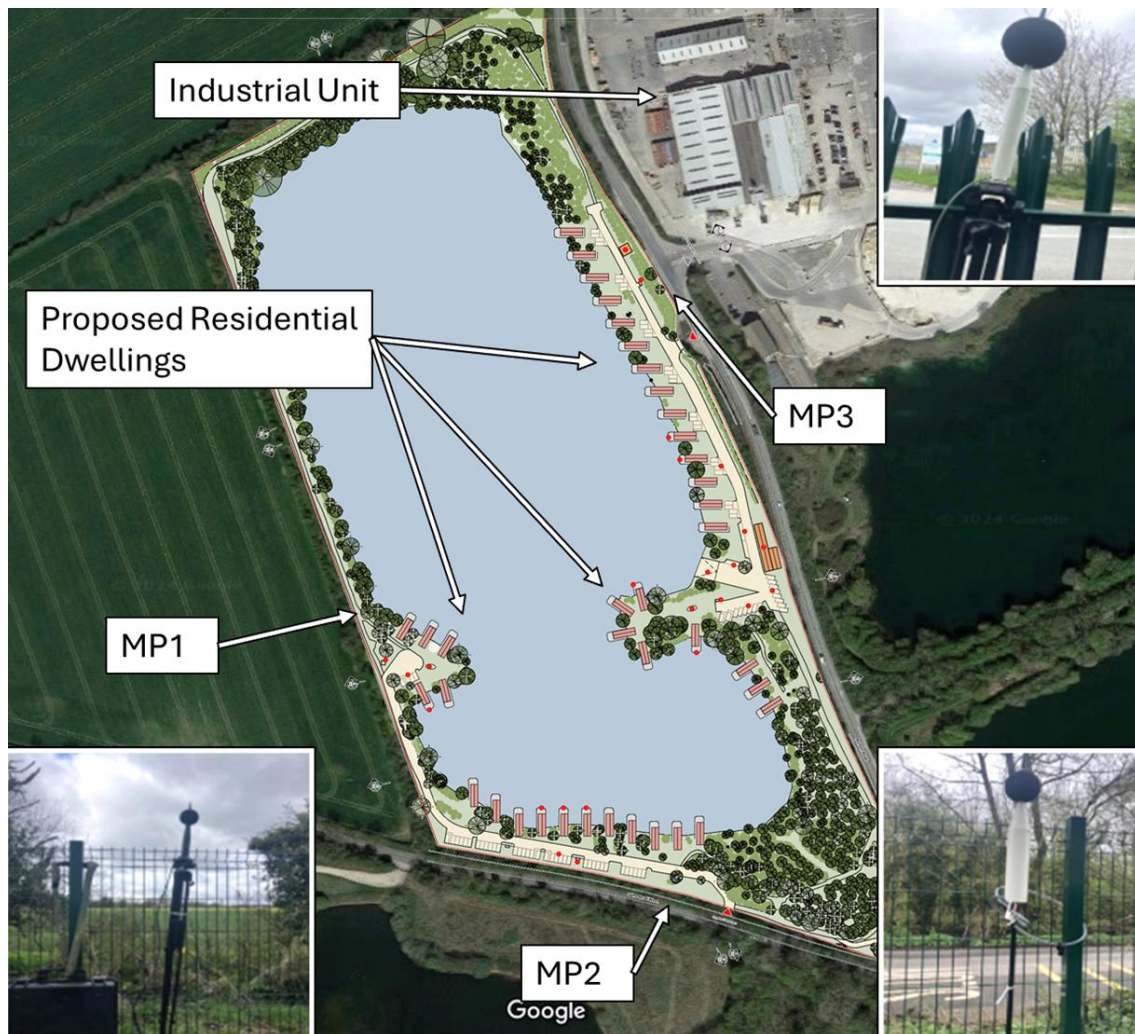


Figure 5: Site Location Plan

4. SOUND LEVEL SURVEY

4.1. Background Sound Level Survey

To assess the impact of existing sound sources, a sound level survey has been conducted at the development site to determine sound levels incident on the proposed residential units.

The sound level survey was set up by Alfie Morgan of ACA Acoustics and carried out over multiple 24-hour periods between 2nd and 5th April 2024. The first measurement location was at the west of the site overlooking a field, the second measurement location was at the south of the site overlooking Spine Road West, the third measurement location was at the east of the site,

overlooking the nearby industrial unit, and Ashton Road. A manned survey of lorries entering and exiting the Aggregate Industries site was also conducted.

The following equipment was used during the survey; the sound level meters were calibrated before the survey and checked after with no deviation noted.

Equipment	Serial Number
Svantek Class 1 sound level meter type SVAN971, complete with MOLES weatherproof outdoor environmental kit	84045
NTi Audio Class 1 sound level meter type XL2-TA complete with weatherproof and lockable outdoor environmental kit	A2A-10964-E0
Svantek Class 1 sound level meter type SV 307	84914
Svantek calibrator type SV33B. Compliant to IEC 60942-1:2003	83826

Table 3: Equipment used during the sound level survey

Weather conditions during the sound level survey were somewhat inconsistent with sporadic periods of rain towards the latter days which have been omitted from the assessment, however it remained mostly dry, and cloudy. Weather conditions are not considered to have impacted the outcome of the survey.

Results of the survey in terms of raw data are shown below, with Figure 6, the results to the west of the site, Figure 7, the results from the south of the site, and Figure 8, the results to the east of the site.

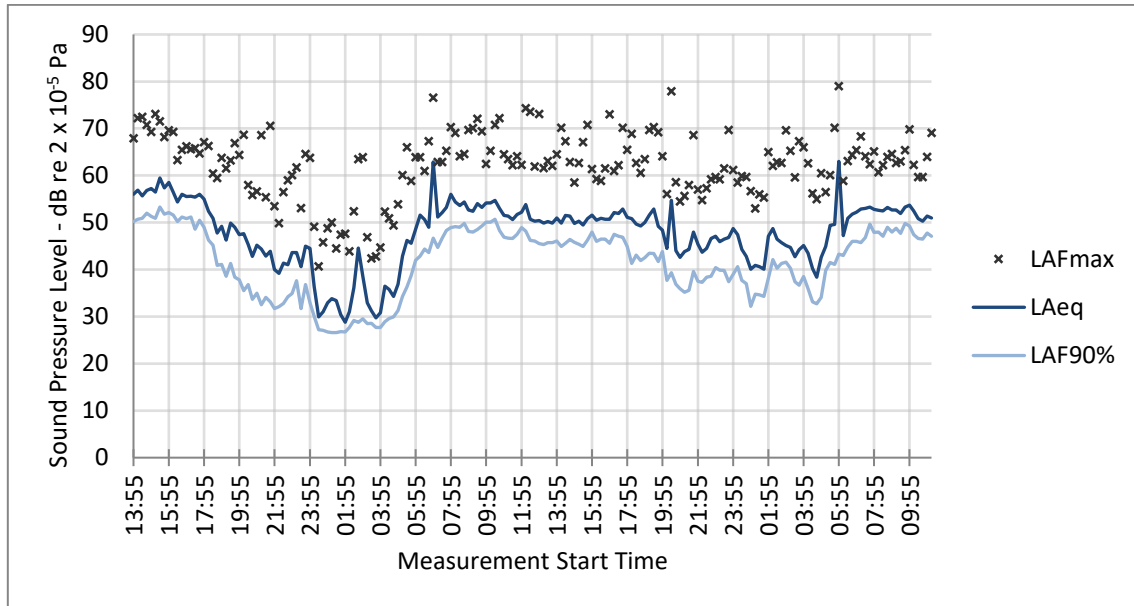


Figure 6: Sound level survey results at the west of site.

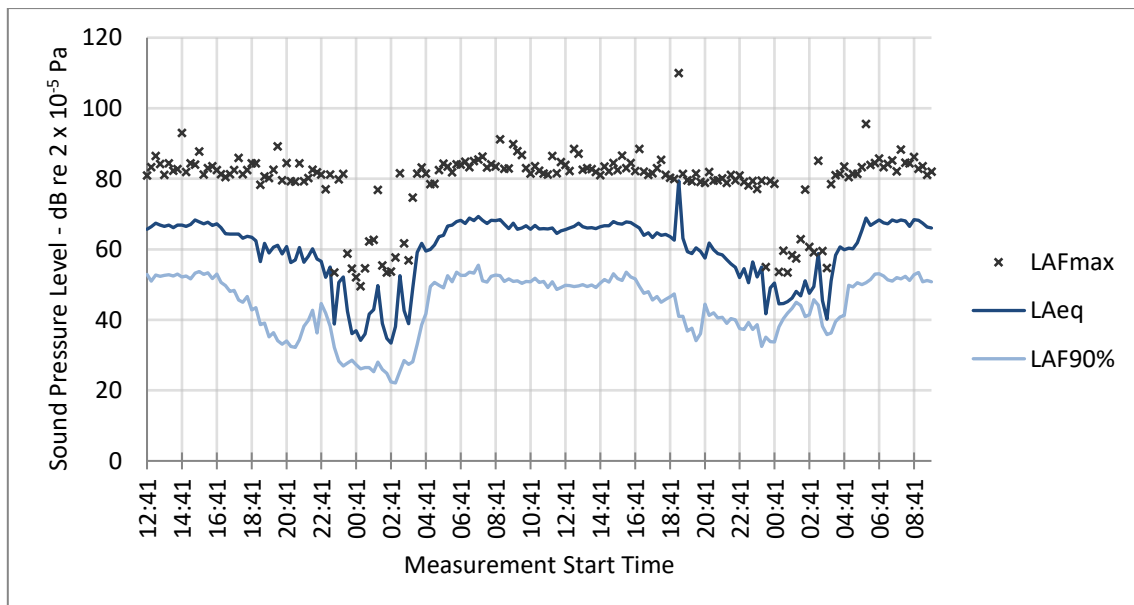


Figure 7: Sound level survey results south of the site

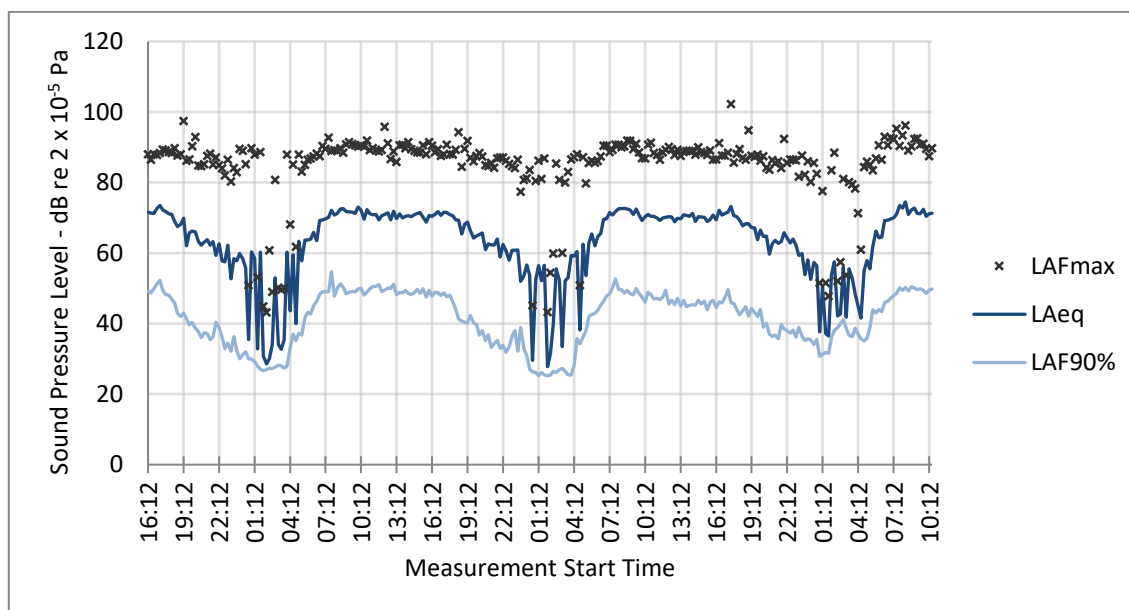


Figure 8: Sound level survey results east of the site

Summary of the daytime and night-time sound level results are shown in tabular form in Table 4. These have been incorporated into the 3D noise map model to calculate sound levels at the proposed holiday homes.

Assessment location	Daytime (07:00 – 23:00) LAeq	Night-Time (23:00 – 07:00) LAeq	Night-Time (23:00 – 07:00) Typical LAfmax
West of Site	52 dB	50 dB	65 dB
South of Site	66 dB	61 dB	81 dB
East of Site	70 dB	61 dB	87 dB

Table 4: Summary sound level survey results

Table 5 below shows the results of a manned survey, situated overlooking the road opposite the opening to the Aggregate Industries site.

Location		Description	Measured Level
Opposite opening for Aggregate Industries site	Ambient Sound Level	Between 09:00 – 10:00 hours, site open and lorries entering and leaving	72dBA
	Residual Sound Level	Between 08:00 – 09:00 hours, site closed and no lorries entering and leaving	72dBA
	Specific sound level	≤62dB	

Table 5: Summary results of the manned survey of a lorry exiting Aggregate Industry Site.

In accordance with BS 4142:2014+A1:2019 the prevailing background sound level is not necessarily taken to be the lowest recorded values, but rather the level that best represents the typical background sound level in the area over a defined period.

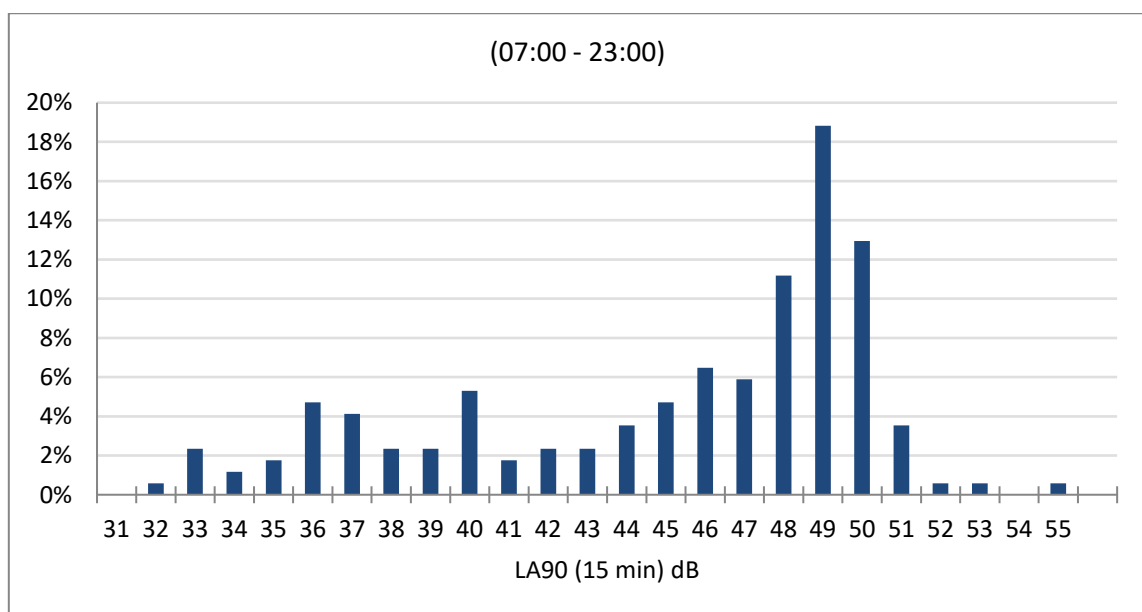


Figure 9: Statistical analysis of LA90 distribution over daytime period of Aggregate Industries operations

A typical daytime background sound level of LA90 49dBA has been used within the assessment and is representative of background sound levels during the operating times of the industrial site.

5. 3D NOISE MAP MODEL OF ENVIRONMENTAL NOISE SOURCES

The site is of a large development involving multiple dwellings over a large area. In order to calculate the sound levels that would be experienced at the façade of the proposed dwellings. A computer calculation model has been set up using iNoise proprietary noise mapping software,

based on the calculation procedures of ISO 9613-1/2 standards and the associated ISO 17534 quality standard to determine the reduction of sound around the development property.

The following data and assumptions have been included within the computer model:

- The computer model uses a source sound level achieving the specific sound level of LAeq 52dB at MP1, LAeq 66dB at MP2, and LAeq 70dB at MP3, during the day, and LAeq 50dB at MP1, LAeq 61dB at MP2, and LAeq 61dB at MP3, during the night-time.
- A receiver height of 1.5 meters for the residential windows has been taken as appropriate.
- The assessment assumes moderate downwind propagation from the source to all receptors.
- Ground absorption coefficient assumed to be 0 (fully reflective hard ground) for the water, and an absorption coefficient of 1 has been used for the grassy areas surrounding the lake.
- The sound reflection coefficient from existing buildings is assumed to be 0.8, equating to traditional buildings with windows, small additions, or bays.

The noise map has been developed in 2 separate scenarios. The first with no acoustics screening to the proposed dwellings and the second with screens to the Southern and Eastern sides of the site.

Printouts from the noise maps below show sound levels across the site with inclusion of acoustic screens during the daytime and nighttime respectively.

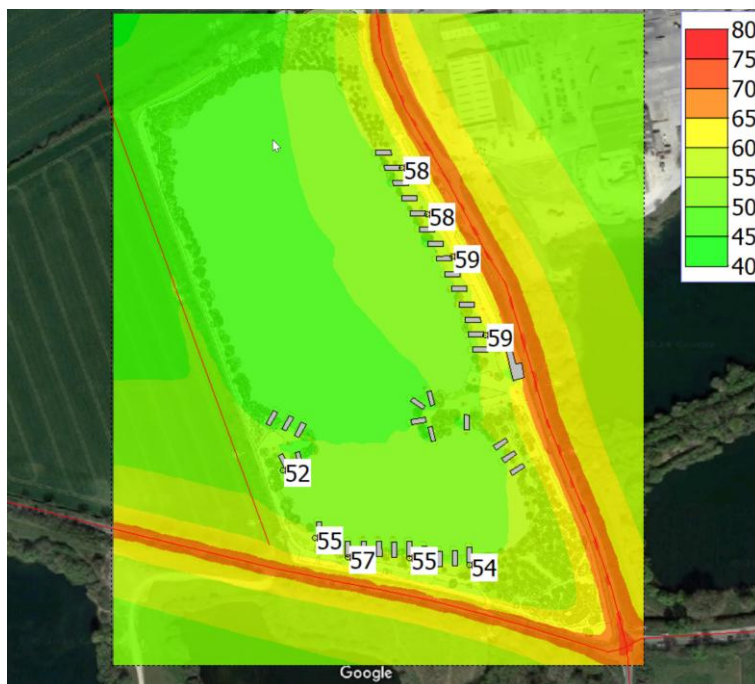


Figure 10: Computer Model of site with no barriers

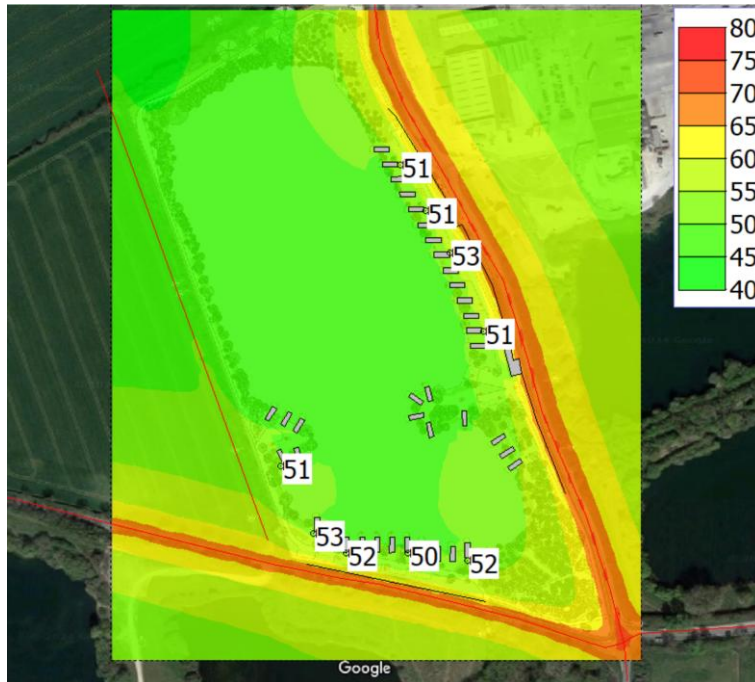


Figure 11: Proposed Daytime 3D Model, with acoustic barriers

As shown in Figure 12 below ACA Acoustics have grouped the buildings into three categories; Red, for Dwellings most impacted by noise on Ashton Road; Green, for dwellings least impacted by noise to the West side of the site; and Yellow, for dwellings towards the south of the site which sit between these two categories.



Figure 12: Map of site showing the level of noise impact on dwellings (No barrier)

Design of the façade sound insulation performance has been conducted using the calculated levels below. These levels include the acoustic barriers detailed within Section 8.

Highlight Colour	Daytime (07:00 – 23:00) LAeq	Night-Time (23:00 – 07:00) LAeq	Night-Time (23:00 – 07:00) Typical LAfmax
Green	51 dB	47 dB	64 dB
Yellow (With Barrier)	53 dB	48 dB	68 dB
Red (With Barrier)	53 dB	44 dB	70 dB

Table 6: Summary sound level results at dwellings through iNoise model

4 ASSESSMENT OF COMMERCIAL NOISE FROM THE NEARBY INDUSTRIAL USE

Assessment of noise emissions from the nearby Aggregate Industries has been undertaken in Table 7 below using measured sound levels during the manned sound level survey and backgrounds from the unmanned survey. Source sound levels have been corrected by -10dB (70dB – 60dB) as calculated within the 3D noise map model shown in Section 5 from the measurement position at the roadside to the proposed holiday homes.

Description	At entrance to Aggregate Industries Site	Relevant Clause	Commentary
Specific level at measurement position	LAeq ≤62dB		Logarithmic subtraction of residual level from ambient level.
Correction of specific sound level to development site	LAeq ≤52dB		
Background sound level	LA90 49dB	8.3	Representative background sound level over daytime period
Acoustic feature correction	0dB	9.2	Sound levels from the Aggregate Industries site are very low compared to the residual daytime sound level at the development site of 60dB, calculated in Section 5, during the daytime, and so no acoustic feature corrections are applicable.

Description	At entrance to Aggregate Industries Site	Relevant Clause	Commentary
Rating level	L _{Ar} ≤52dB	9.2	
Excess of rating level over background sound level	≤3dB	11	Assessment indicates, without mitigation, a low likelihood of adverse impact depending on the context

Table 7: BS 4142:2014+A1:2019 assessment of commercial noise sources

The initial outcome of a BS 4142:2014+A1:2019 assessment of the nearby commercial noise sources is that, without mitigation, there is a low likelihood of adverse impact, depending on the context.

In order to account for any potential small risk of adverse impact from the Aggregate Industries site, ACA Acoustics propose to adopt an internal acoustic criteria 5dB lower than that within BS 8233:2014. This will ensure that any remaining impact is mitigated to future occupants of the properties.

6. ProPG STAGE 1 INITIAL NOISE RISK ASSESSMENT

Results of the sound level survey at the most affected dwellings with no acoustic mitigation have been plotted on the image in Figure 2 to determine the relevant noise risk category.

Results of the initial risk assessment using the measured sound levels are included in Figure 13 below.

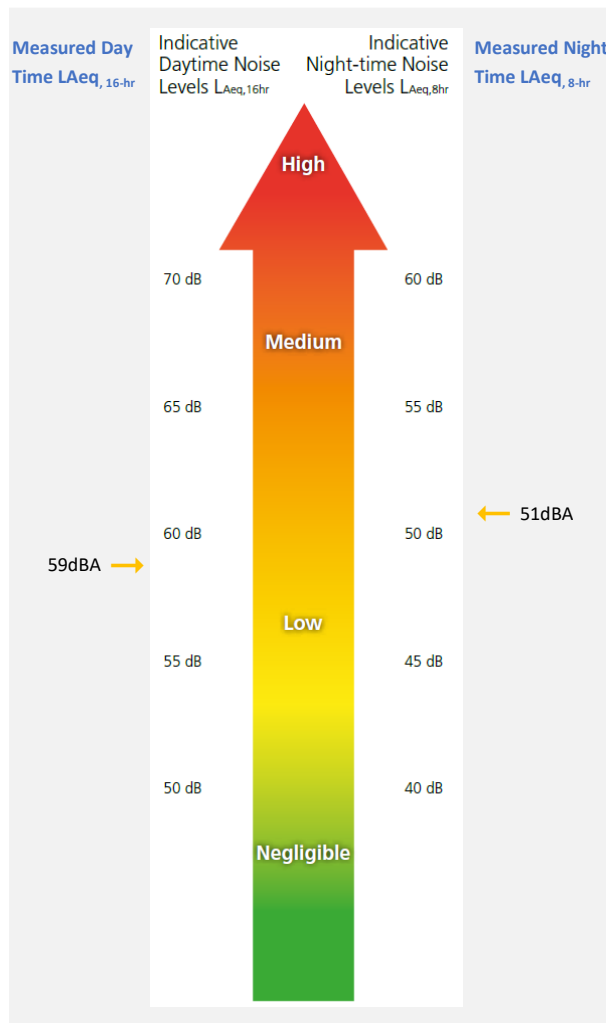


Figure 13: ProPG initial noise risk assessment of the most affected properties assuming no screening is installed.

The initial site risk assessment indicates that the site is in an area where there is a medium to low risk of adverse impacts to future occupants of the dwellings unless an appropriate noise mitigation strategy is implemented.

It is appropriate to consider that this is the raw data and does not include any proposed mitigation. Paragraph 2.12 of ProPG confirms that:

“It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced.”

7. ProPG STAGE 2 ACOUSTIC DESIGN STATEMENT

As discussed in Section 2.3, Stage 2 of ProPG is separated into four elements: an overview ensuring a good acoustic design process, assessment of internal sound levels, consideration of sound levels in external amenity areas, and finally an assessment of any other relevant issues.

The four elements are considered in more detail within this Section.

7.1. Element 1 – Good Acoustic Design Process

The pre-planning application advice contained in ProPG confirms:

“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 [Acoustic Design Statement] which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrates that a significant adverse noise impact will be avoided in the finished development.”

ProPG and the supplementary documents provide guidance on the typical matters that should be considered in an Acoustic Design Statement. These matters are discussed in Table 8.

Principle/Topic	Discussion
Identify significant existing and potential noise sources and measure or estimate sound levels	Road traffic has been identified as the dominant noise source. Results of the sound level survey are included in Section 4.
Consider the feasibility of reducing sound levels or relocating noise sources	It is not feasible to relocate the noise sources as part of this application.
Consider the potential to mitigate sound through planning of the site and orientation of the buildings	Due to the dual aspect form of the proposed development and the proposed number of rooms it is not feasible to mitigate sound through the orientation of all noise-sensitive rooms to the rear of the properties.
Mitigating the sound through use of barriers or screens	This has been proposed as an option within this assessment
Select construction types and methods to achieve the internal sound level criteria	An appropriate acoustic specification for façade elements has been proposed. Refer Section 7.3.
Consider the acoustic impact of the proposed ventilation strategy	This is discussed in more detail in Section 7.2

Principle/Topic	Discussion
Assess sound levels to external amenity areas	This is discussed in more detail in Section 7.4.
Assess the viability of alternative solutions	Where appropriate, alternative solutions are discussed, and the most appropriate scheme has been put forward.
Examine the effects of noise control measures on ventilation, fire regulation, H&S, costs, CDM, or other unintended consequence	Under the Construction (Design and Management) Regulations 2015, ACA Acoustics are acting as a Designer. This Acoustic Design Statement and the supporting evidence has considered best practice to reduce or control foreseeable risks. It is recommended that other relevant parties, including the Principal Designer, consider all non-acoustic aspects of the design.

Table 8: Acoustic Design Statement details

7.2. Ventilation Strategy

Section 2.3 confirms that any site with a noise risk assessment above ‘Negligible’ would fail to achieve internal sound level criteria with windows open and in this instance ProPG and the supplementary guidance requires that internal sound level criteria are achieved whilst providing the ‘whole dwelling ventilation’ rate as set out in The Building Regulations Approved Document F through the use of above-window or through-wall trickle ventilators.

It is usual to satisfy internal sound level criteria whilst achieving the background ventilation rate defined by Approved Document F of the Building Regulations, rather than for the purge ventilation rate. It is therefore anticipated that it will be necessary to incorporate an acoustic ventilation scheme into the design such that residents can achieve background ventilation without necessarily needing to open windows.

Values in Table 9 below show a specification schedule of ventilator sound insulation performance for the development, used in the computer model. Note that there are many different passive ventilators including through-wall type and those built into the window frame. If the $D_{n,e,w}$ performance is not lower than that shown Table 9 then any alternative ventilator may be used. Where a room has windows to two facades it is recommended that ventilators are incorporated into windows/walls on the quieter façade.

Description	Dn,e,w (dB)	Typical Ventilator Type	Zone
Passive Ventilation	35	Hit & Miss Trickle Vent (4000mm ²)	Green
	38	Acoustic Trickle Vent (4000mm ²)	Yellow
	45	Passivent Fresh 90dB	Red

Table 9: Specification for ventilator Element Normalized Level Difference – Dn,e,w (dB)

In accordance with Approved Document O of The Building Regulations, where sound levels to inside bedrooms exceed LAeq, 8-hour 40dB or LAfmax 55dB more than 10 times per night, then it may not be appropriate to rely on open windows to mitigate overheating. In this instance dynamic thermal modelling may be necessary to determine an appropriate overheating mitigation strategy.

Based on calculated levels to the façades and allowing a reduction through a partially open window of 9dBA as detailed in Section 2.4, internal sound levels within bedrooms to the front façade will be nominally LAeq 43dB and LAfmax 69dB with windows open. An alternative overheating strategy may be appropriate to ensure that occupants will not need to open windows in order to mitigate overheating to these bedrooms at night. However, detailed thermal and ventilation design is beyond the scope of this assessment and should be considered by others accordingly.

7.3. Element 2 – Internal Noise Level Guidelines

A scheme for sound insulation is necessary to ensure sound levels inside rooms of the new residential dwelling are reasonable and comply with the requirements of BS 8233:2014.

A computer model has been set up using the measured sound levels incident on the façade of the development along with anticipated façade elements. The computer model is based on the calculation procedures outlined in BS EN ISO 12354-3:2000 and BS 8233:2014.

The assessment is based on drawings provided by the client, with reference 'CWP-001 Proposed Sketch Site Layout r1 230906'. Confirmation of the acoustic performance of the building envelope elements used in the calculation model is provided below.

ACA Acoustics understand that the fabric of the external walls and roof of the proposed holiday homes is a standardised construction by the manufacturer and alterations are not possible. As such assessment has been carried out on this basis.

Description	Rw (dB)	Rw + C'tr (dB)	Typical Construction
Façade walls to all zones	43	36	Lightweight Cladding, Insulated Timber Frame
Glazing to all zones	39	36	Triple Glazing, 6-14-4-14-8.8 or Equivalent
Roof to all zones	43	36	Lightweight Cladding, Insulated Timber Frame

Table 10: Acoustic performance specification for façade elements with acoustic barrier to the roads

Note that the constructions provided are typical and variations on the specification would be acceptable, so long as the installed construction achieved the specified sound insulation performance. The specification for glazed elements is for the window/door as a complete unit, including frames and seals. It is recommended the glazing supplier submit test data confirming their unit will comply with the specified performance.

A copy of the acoustic calculations for daytime and night-time noise intrusion into sample rooms is provided in Appendix A. Summary results are confirmed in Table 11 below and demonstrate that sound levels within rooms of the proposed residential units will comply with guidance limits in British Standard BS 8233:2014.

Plot/Room	Description	Calculated Internal Sound Level	Criteria
Living Room (Green Zone)	Daytime LAeq	27dB	≤ 30dB
	Night-time LAeq	-	-
	Night-time LAfmax	-	-
Bedroom (Green Zone)	Daytime LAeq	28dB	≤ 30dB
	Night-time LAeq	24dB	≤ 25dB
	Night-time LAfmax	41dB	≤ 45dB
Living Room (Yellow Zone)	Daytime LAeq	29dB	≤ 30dB
	Night-time LAeq	-	-
	Night-time LAfmax	-	-
Bedroom (Yellow Zone)	Daytime LAeq	29dB	≤ 30dB
	Night-time LAeq	24dB	≤ 25dB
	Night-time LAfmax	43dB	≤ 45dB
Living Room (Red Zone)	Daytime LAeq	28dB	≤ 30dB
	Night-time LAeq	-	-
	Night-time LAfmax	-	-

Bedroom (Red Zone)	Daytime LAeq	28dB	≤ 30dB
	Night-time LAeq	21dB	≤ 25dB
	Night-time LAfmax	45dB	≤ 45dB

Table 11: Summary internal sound levels within sample habitable rooms with external facades as proposed by the client and acoustic barriers to the roads/ individual properties

7.4. Element 3 – External Amenity Area Noise Assessment

The proposed developments are in a place of natural beauty, with amenity space around the entire development, including the lake itself. With inclusion of mitigation treatments as detailed within this report, daytime external sound levels across the site do not exceed 55dB achieving the guideline sound level for a reasonable level of external amenity.

7.5. Element 4 – Assessment of Other Relevant Issues

No other relevant issues have been identified within the proposed development.

8. ACOUSTIC MITIGATION TREATMENTS

8.1. Acoustic barrier

It is understood that alterations to the fabric of the holiday homes is not possible due to the default nature of the construction by the manufacturer. As such it is recommended that acoustic barriers be installed to control sound levels from nearby roads.

The screens should be not less than 2 meters high, and would typically be formed of minimum 20mm thick laths, overlapped or tongue & groove jointed with no gaps. The screens must also extend down to the ground with no gaps, and should be designed such that sound transmission through the screen is at least 10dB lower than levels over the top of the screen.

With benefit of the proposed acoustic screens, along with the external façade treatments as shown in Table 10, which represent the typical construction of the proposed 'JB Silver Moon' units, all dwellings will meet guidelines set out in BS:8233:2014.

Suggested layout of the screens can be seen in Figure 14 below.



Figure 14: Proposed acoustic screen locations

9. CONCLUSION

ACA Acoustics have undertaken a sound level survey in the vicinity. A ProPG Stage 1 initial noise risk assessment has indicated the site is in a low/medium risk area. Through a good acoustic design process ACA Acoustics have developed an Acoustic Design Statement, included in this report. In addition, nearby industrial and commercial noise sources have been shown to have a low likelihood of adverse impacts on future occupants.

Allowing for the benefit of the acoustic specification of façade elements shown in this report, calculated internal sound levels within habitable rooms will be at least 5dB lower than criteria set out in ProPG and BS 8233:2014.

It is the author's opinion that the Acoustic Design Statement has demonstrated that potential adverse or significant adverse impacts can be adequately mitigated to ensure noise is not detrimental to the amenity of future occupants.

In accordance with guidance in ProPG and BS 8233:2014, it is recommended that planning consent may be granted for the proposed development.

Appendix A

Acoustic Calculations

Lake 62, Cotswold Water Park

Reference Green Living Room

Description

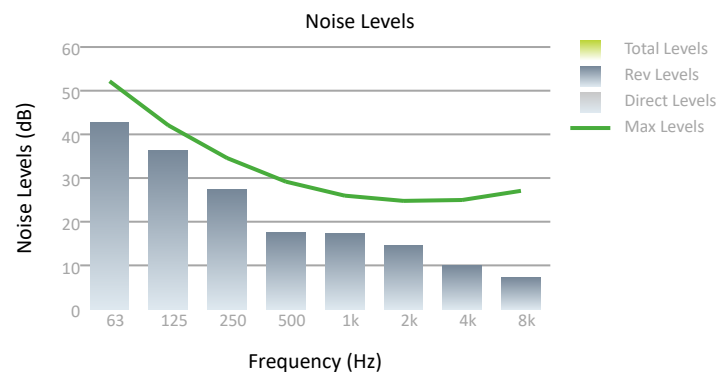
Target Sound Level -

Max Sound Level 35dB(A)

Calculated Sound Level 25.5dB(A)

Calculated Tmf T60 (s) 0.53

Volume (m³) 57.5

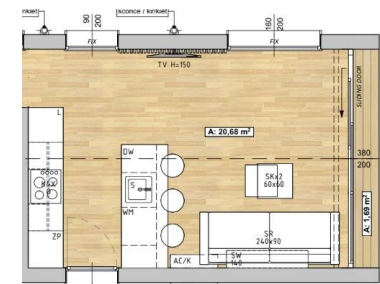
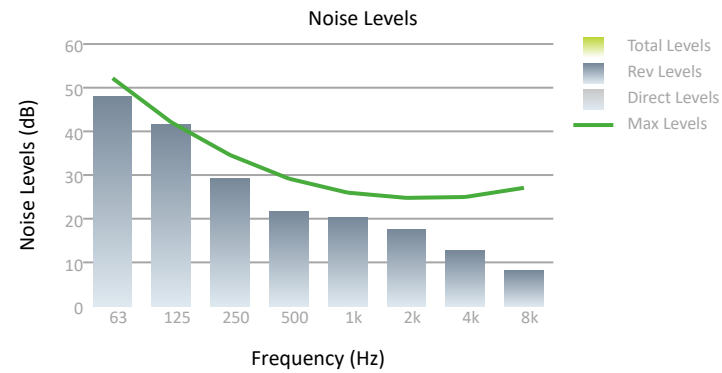


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	42.8	36.2	27.3	17.5	17.2	14.6	10.0	7.3

Lake 62, Cotswold Water Park

Reference	Yellow Living Room
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	29.5dB(A)
Calculated Tmf T60 (s)	0.53
Volume (m ³)	57.5

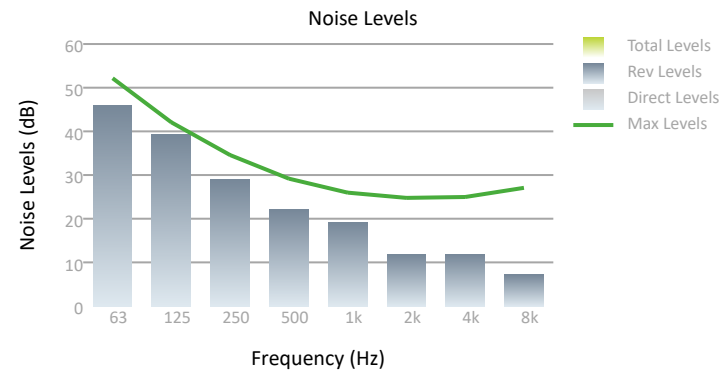


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	47.9	41.6	29.2	21.7	20.3	17.6	12.6	8.2

Lake 62, Cotswold Water Park

Reference	Red Living Room
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	27.8dB(A)
Calculated Tmf T60 (s)	0.53
Volume (m ³)	57.5

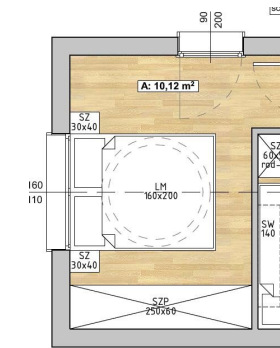
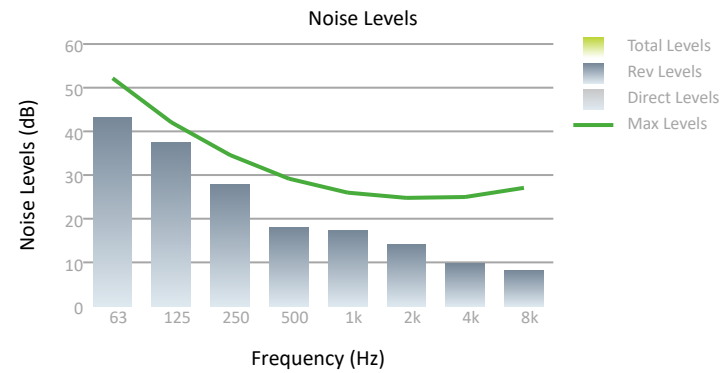


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	45.8	39.2	28.9	22.1	19.2	11.8	11.9	7.2

Lake 62, Cotswold Water Park

Reference	Green Bedroom Daytime LAeq
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	26dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

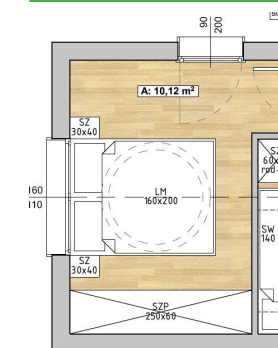
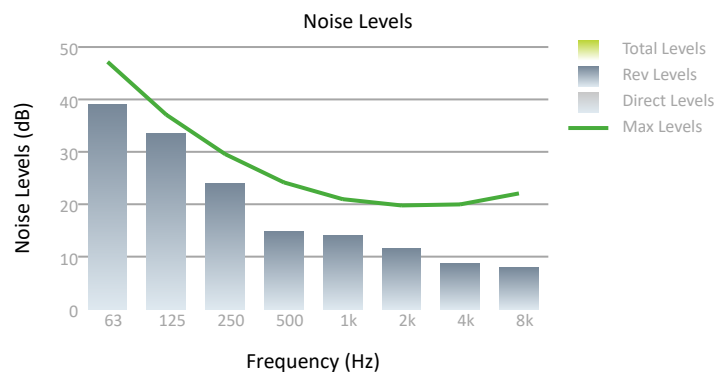


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	43.1	37.4	27.8	18.1	17.2	14.1	9.8	8.2

Lake 62, Cotswold Water Park

Reference	Green Bedroom Night-time LAeq
Description	
Target Sound Level	-
Max Sound Level	30dB(A)
Calculated Sound Level	22.6dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

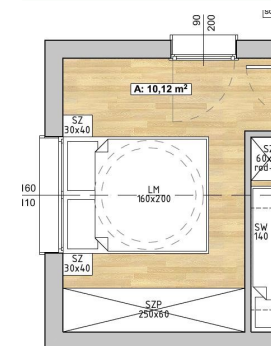
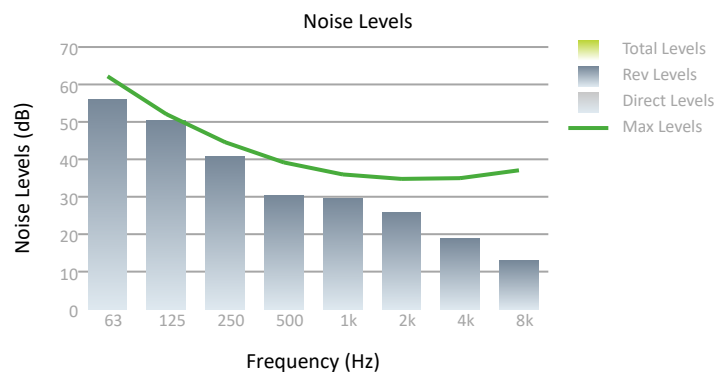


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Night)	1	39.1	33.4	23.9	14.9	14.1	11.6	8.7	7.9

Lake 62, Cotswold Water Park

Reference	Green Bedroom Night-time LAfmax
Description	
Target Sound Level	-
Max Sound Level	45dB(A)
Calculated Sound Level	38.7dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

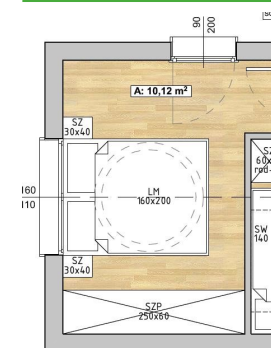
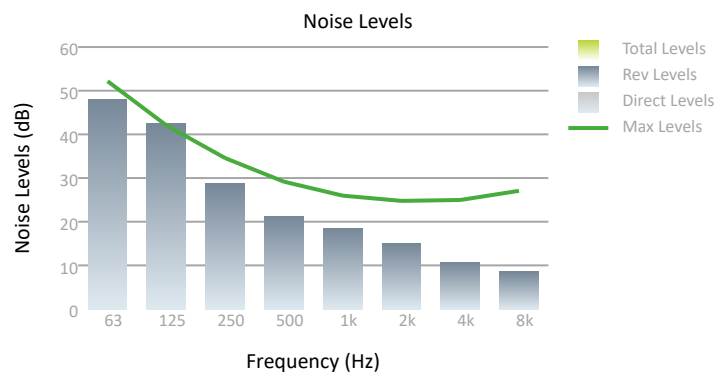


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax, ff (Night)	1	56.1	50.4	40.7	30.4	29.5	25.8	18.9	13.0

Lake 62, Cotswold Water Park

Reference	Yellow Bedroom Daytime LAeq
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	29.5dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

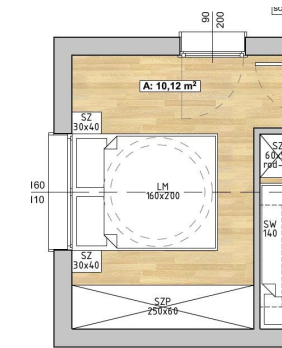
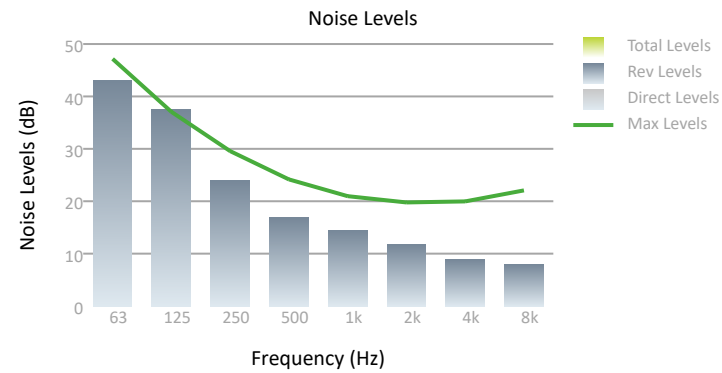


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	48.1	42.5	28.8	21.3	18.5	15.0	10.7	8.5

Lake 62, Cotswold Water Park

Reference	Yellow Bedroom Night-time LAeq
Description	
Target Sound Level	-
Max Sound Level	30dB(A)
Calculated Sound Level	24.9dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

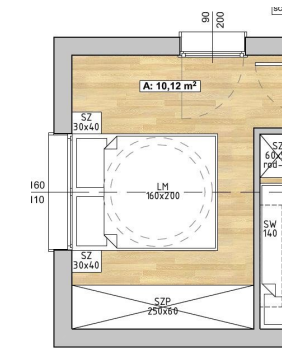
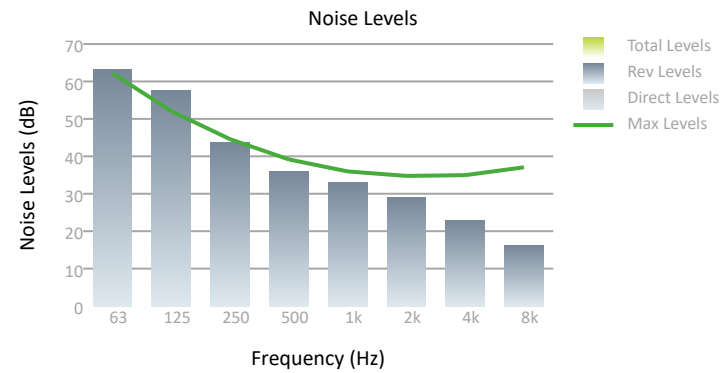


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Night)	1	43.1	37.5	23.9	16.9	14.5	11.7	8.9	8.0

Lake 62, Cotswold Water Park

Reference	Yellow Bedroom Night-time LAfmax
Description	
Target Sound Level	-
Max Sound Level	45dB(A)
Calculated Sound Level	44.3dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

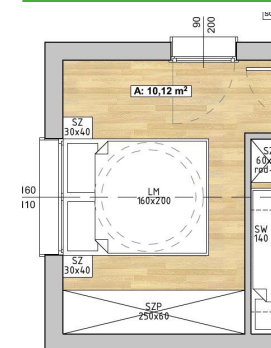
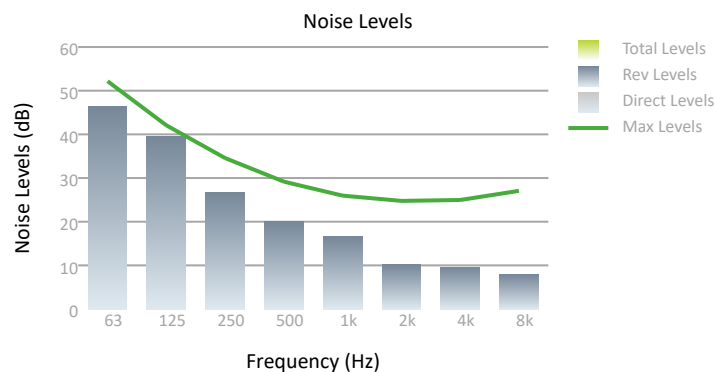


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax, ff (Night)	1	63.1	57.5	43.8	36.0	33.0	29.0	22.8	16.2

Lake 62, Cotswold Water Park

Reference	Red Bedroom Daytime LAeq
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	27.1dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

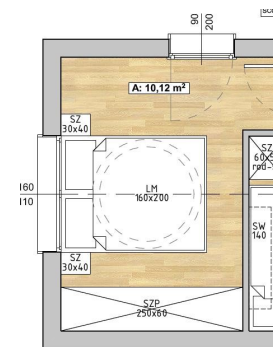
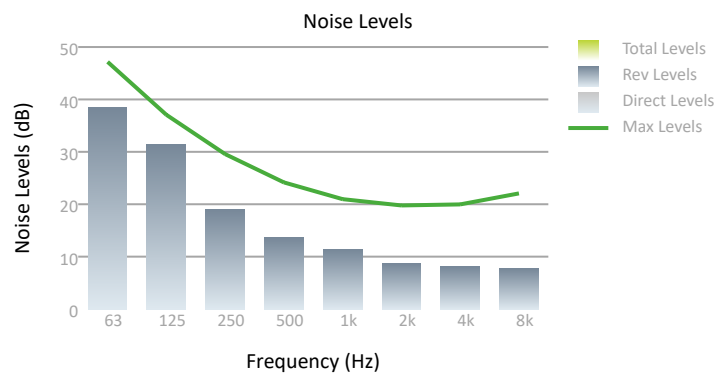


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	46.4	39.4	26.6	20.0	16.5	10.2	9.6	7.9

Lake 62, Cotswold Water Park

Reference	Red Bedroom Night-time LAeq
Description	
Target Sound Level	-
Max Sound Level	30dB(A)
Calculated Sound Level	20.4dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m³)	27.5

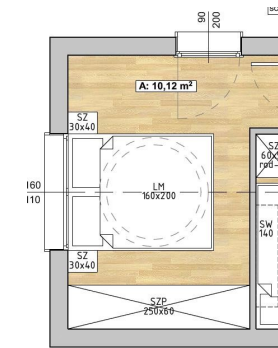
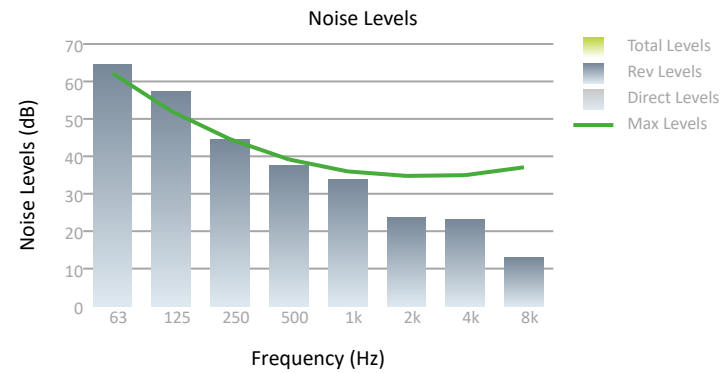


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Night)	1	38.4	31.5	19.1	13.7	11.4	8.7	8.1	7.8

Lake 62, Cotswold Water Park

Reference	Red Bedroom Night-time LAfmax
Description	
Target Sound Level	-
Max Sound Level	45dB(A)
Calculated Sound Level	44.8dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5



Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax, ff (Night)	1	64.4	57.4	44.6	37.6	33.7	23.6	23.2	13.0

Lake 62, Cotswold Water Park

Reference Green Living Room

Description

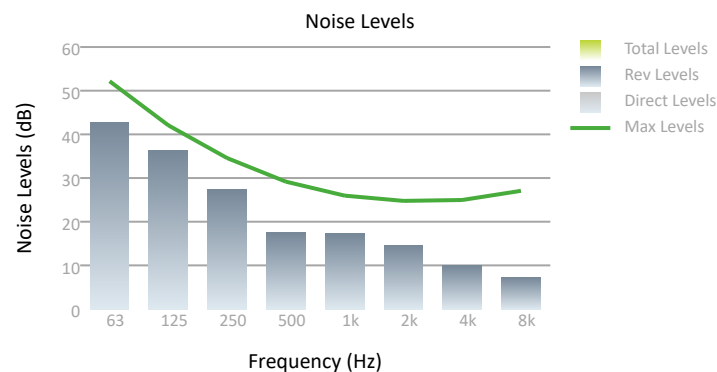
Target Sound Level -

Max Sound Level 35dB(A)

Calculated Sound Level 25.5dB(A)

Calculated Tmf T60 (s) 0.53

Volume (m³) 57.5

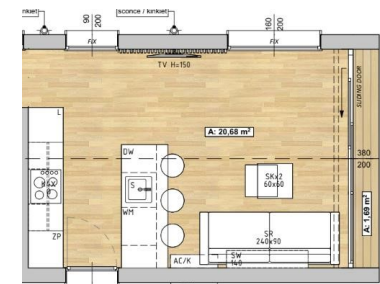
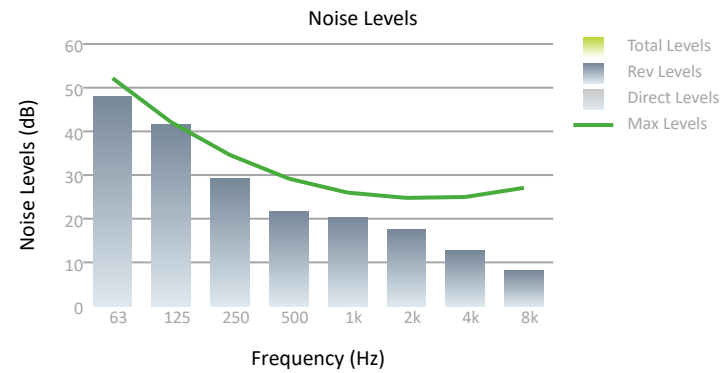


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	42.8	36.2	27.3	17.5	17.2	14.6	10.0	7.3

Lake 62, Cotswold Water Park

Reference	Yellow Living Room
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	29.5dB(A)
Calculated Tmf T60 (s)	0.53
Volume (m ³)	57.5

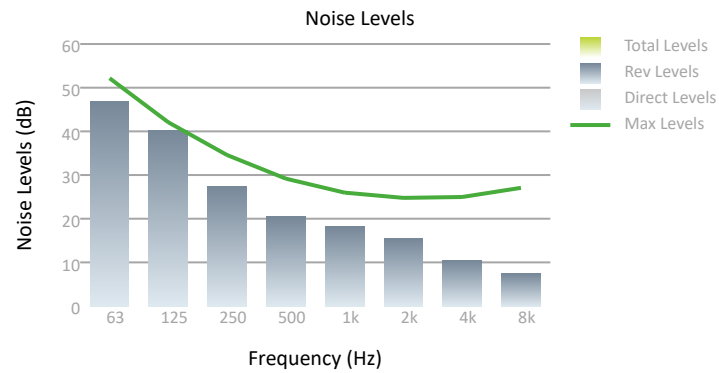


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	47.9	41.6	29.2	21.7	20.3	17.6	12.6	8.2

Lake 62, Cotswold Water Park

Reference	Red Living Room
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	28.1dB(A)
Calculated Tmf T60 (s)	0.53
Volume (m ³)	57.5

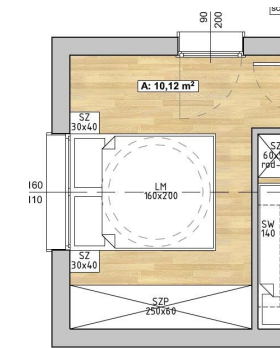
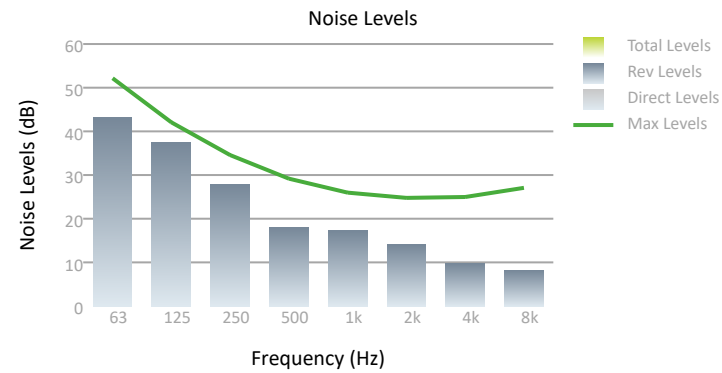


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	46.8	40.3	27.4	20.4	18.2	15.4	10.5	7.4

Lake 62, Cotswold Water Park

Reference	Green Bedroom Daytime LAeq
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	26dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

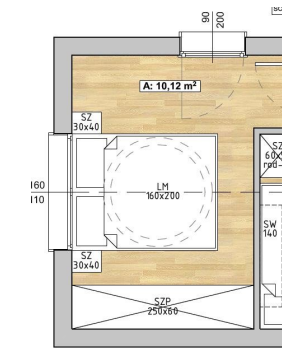
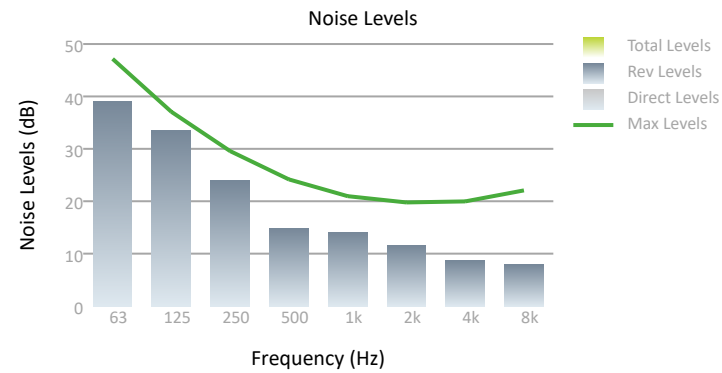


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	43.1	37.4	27.8	18.1	17.2	14.1	9.8	8.2

Lake 62, Cotswold Water Park

Reference	Green Bedroom Night-time LAeq
Description	
Target Sound Level	-
Max Sound Level	30dB(A)
Calculated Sound Level	22.6dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

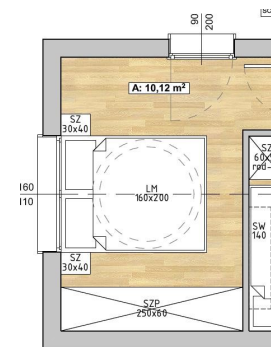
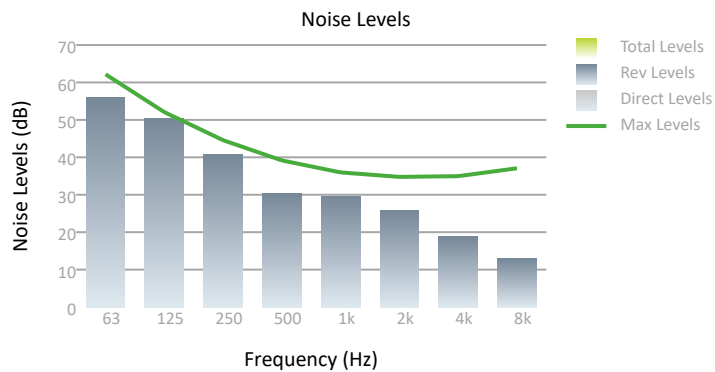


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Night)	1	39.1	33.4	23.9	14.9	14.1	11.6	8.7	7.9

Lake 62, Cotswold Water Park

Reference	Green Bedroom Night-time LAfmax
Description	
Target Sound Level	-
Max Sound Level	45dB(A)
Calculated Sound Level	38.7dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

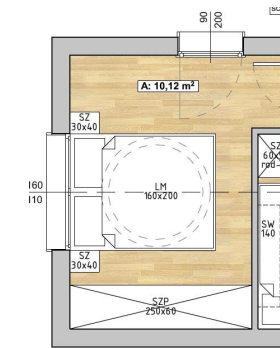
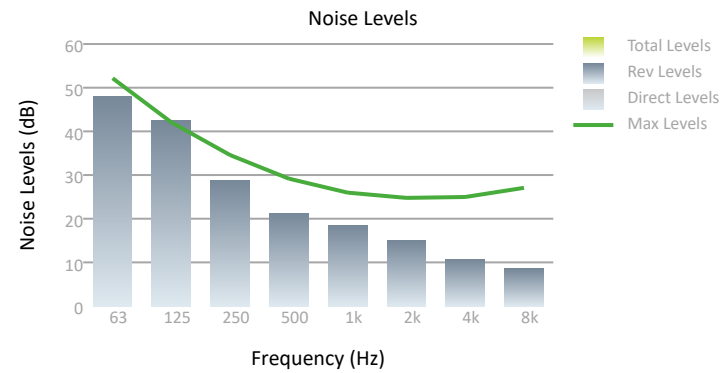


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax, ff (Night)	1	56.1	50.4	40.7	30.4	29.5	25.8	18.9	13.0

Lake 62, Cotswold Water Park

Reference	Yellow Bedroom Daytime LAeq
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	29.5dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

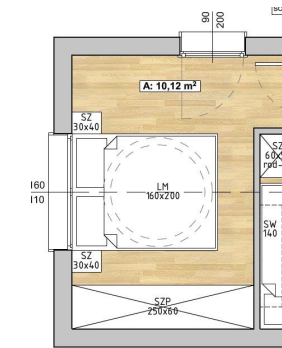
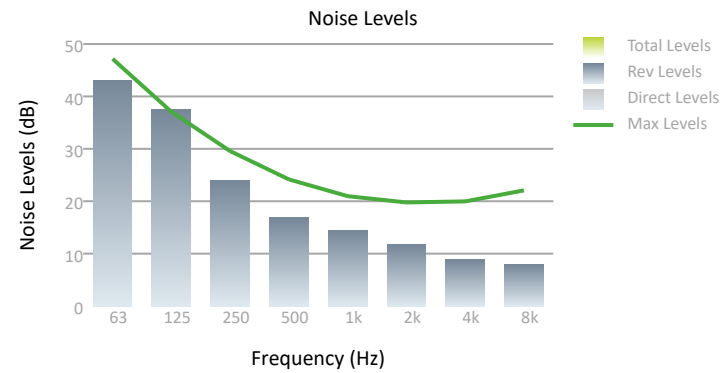


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	48.1	42.5	28.8	21.3	18.5	15.0	10.7	8.5

Lake 62, Cotswold Water Park

Reference	Yellow Bedroom Night-time LAeq
Description	
Target Sound Level	-
Max Sound Level	30dB(A)
Calculated Sound Level	24.9dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

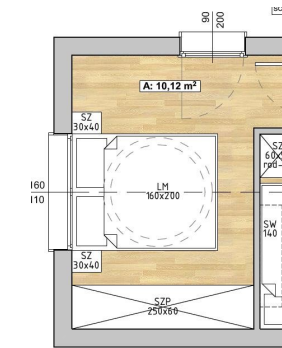
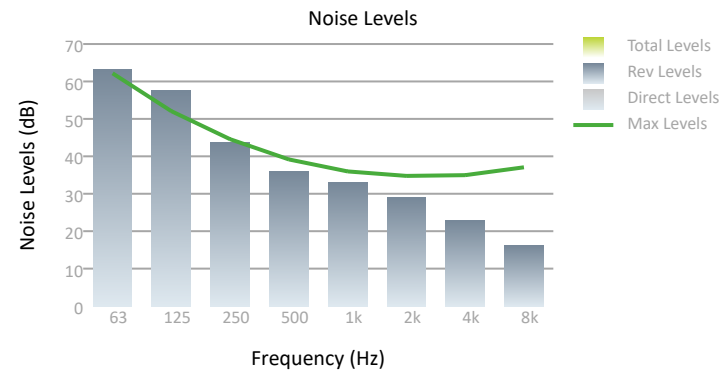


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Night)	1	43.1	37.5	23.9	16.9	14.5	11.7	8.9	8.0

Lake 62, Cotswold Water Park

Reference	Yellow Bedroom Night-time LAfmax
Description	
Target Sound Level	-
Max Sound Level	45dB(A)
Calculated Sound Level	44.3dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

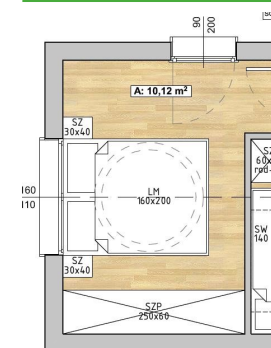
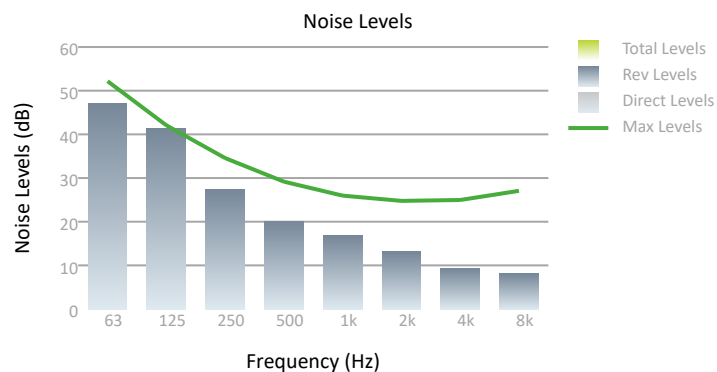


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax, ff (Night)	1	63.1	57.5	43.8	36.0	33.0	29.0	22.8	16.2

Lake 62, Cotswold Water Park

Reference	Red Bedroom Daytime LAeq
Description	
Target Sound Level	-
Max Sound Level	35dB(A)
Calculated Sound Level	28.3dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

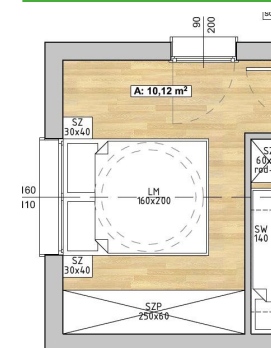
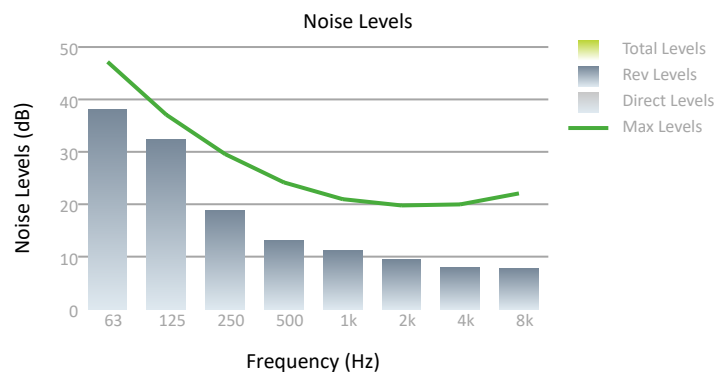


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Day)	1	47.1	41.4	27.4	20.1	16.8	13.1	9.3	8.1

Lake 62, Cotswold Water Park

Reference	Red Bedroom Night-time LAeq
Description	
Target Sound Level	-
Max Sound Level	30dB(A)
Calculated Sound Level	20.6dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5

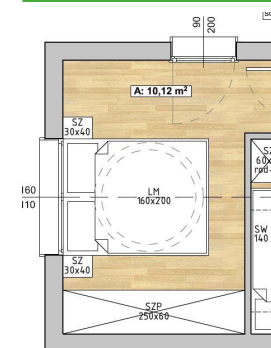
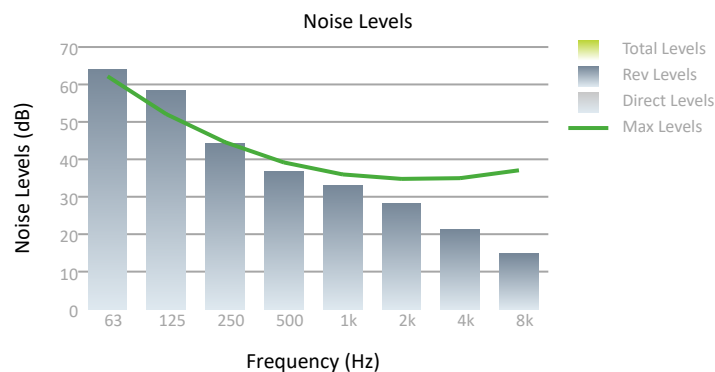


Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq, ff (Night)	1	38.1	32.4	18.8	13.2	11.1	9.4	8.0	7.8

Lake 62, Cotswold Water Park

Reference	Red Bedroom Night-time LAfmax
Description	
Target Sound Level	-
Max Sound Level	45dB(A)
Calculated Sound Level	45dB(A)
Calculated Tmf T60 (s)	0.4
Volume (m ³)	27.5



Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax, ff (Night)	1	64.1	58.4	44.3	36.7	33.0	28.3	21.2	14.7

Calculation Sheet

Green Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	49.0									
Octave Band Frequencies										
Leq,ff		53.0	51.0	47.0	45.0	45.0	41.0	36.0	30.0	Row A
Facade Wall Element										
		-24.4	-27.4	-37.4	-43.4	-48.4	-52.4	-55.4	-59.4	
Facade Glazed Element										
		-25.2	-32.9	-38.1	-44.6	-48.3	-42.2	-56.8	-57.4	
Facade Roof Element										
		-26.0	-29.0	-39.0	-45.0	-50.0	-54.0	-57.0	-61.0	
Ventilators										
		-36.2	-37.2	-30.2	-40.2	-38.2	-37.2	-38.2	-39.2	
Cumulative Lp										
Result		32.7	26.8	18.6	8.8	8.4	6.3	2.1	0.5	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.1	9.5	8.7	8.7	8.7	8.3	7.9	6.8	
Internal Receiver Noise										
Internal Receiver Noise - Green Living Room										
Reverberant Field, LPrev:		42.8	36.2	27.3	17.5	17.2	14.6	10.0	7.3	

Calculation Sheet

Green Bedroom Daytime LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Daytime Leq)										
Source dBA	49.0									
Octave Band Frequencies										
Leq,ff		53.0	51.0	47.0	45.0	45.0	41.0	36.0	30.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-36.4	-37.4	-30.4	-40.4	-38.4	-37.4	-38.4	-39.4	
Cumulative Lp										
Result		32.3	27.1	18.3	8.5	8.2	5.7	2.0	0.5	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Green										
Bedroom Daytime LAeq										
Reverberant Field, LPrev:		43.1	37.4	27.8	18.1	17.2	14.1	9.8	8.2	

Calculation Sheet

Green Bedroom Night-time LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Nighttime Leq)										
Source dBA	45.0									
Octave Band Frequencies										
Leq,ff		49.0	47.0	43.0	41.0	41.0	37.0	32.0	26.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-36.4	-37.4	-30.4	-40.4	-38.4	-37.4	-38.4	-39.4	
Cumulative Lp										
Result		28.3	23.1	14.4	5.4	5.1	3.2	0.9	0.2	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Green										
Bedroom Night-time LAeq										
Reverberant Field, LPrev:		39.1	33.4	23.9	14.9	14.1	11.6	8.7	7.9	

Calculation Sheet

Green Bedroom Night-time LAfmax

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime Lmax)									
Source dBA	62.0								
Octave Band Frequencies									
Leq,ff		66.0	64.0	60.0	58.0	58.0	54.0	49.0	43.0
Row A									
Facade Wall Element									
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6
Facade Glazed Element									
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0
Facade Roof Element									
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4
Ventilators									
		-36.4	-37.4	-30.4	-40.4	-38.4	-37.4	-38.4	-39.4
Cumulative Lp									
Result		45.3	40.0	31.2	20.9	20.5	17.4	11.1	5.2
ISO 12354-3 Lfs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Green Bedroom Night-time LAfmax Reverberant Field, LPrev:		56.1	50.4	40.7	30.4	29.5	25.8	18.9	13.0

Calculation Sheet

Yellow Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	54.0									
Octave Band Frequencies										
Leq,ff		58.0	56.0	52.0	50.0	50.0	46.0	41.0	35.0	Row A
Facade Wall Element										
		-24.4	-27.4	-37.4	-43.4	-48.4	-52.4	-55.4	-59.4	
Facade Glazed Element										
		-25.2	-32.9	-38.1	-44.6	-48.3	-42.2	-56.8	-57.4	
Facade Roof Element										
		-26.0	-29.0	-39.0	-45.0	-50.0	-54.0	-57.0	-61.0	
Ventilators										
		-34.2	-33.2	-36.2	-41.2	-40.2	-39.2	-38.2	-39.2	
Cumulative Lp										
Result		37.8	32.1	20.5	12.9	11.6	9.3	4.7	1.4	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.1	9.5	8.7	8.7	8.7	8.3	7.9	6.8	
Internal Receiver Noise										
Internal Receiver Noise - Yellow Living Room										
Reverberant Field, LPrev:		47.9	41.6	29.2	21.7	20.3	17.6	12.6	8.2	

Calculation Sheet

Red Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	60.0									
Octave Band Frequencies										
Leq,ff		64.0	62.0	58.0	56.0	56.0	52.0	47.0	41.0	Row A
Facade Wall Element										
		-31.4	-36.4	-49.4	-57.4	-64.4	-70.4	-75.4	-77.4	
Facade Glazed Element										
		-33.4	-36.4	-41.4	-49.4	-52.4	-53.4	-45.4	-51.4	
Facade Roof Element										
		-36.0	-42.0	-56.0	-60.0	-67.0	-75.0	-75.0	-77.0	
Ventilators										
		-42.2	-41.2	-41.2	-44.2	-47.2	-55.2	-58.2	-61.2	
Cumulative Lp										
Result		35.7	29.8	20.1	13.4	10.4	3.5	4.0	0.4	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.1	9.5	8.7	8.7	8.7	8.3	7.9	6.8	
Internal Receiver Noise										
Internal Receiver Noise - Red Living Room										
Reverberant Field, LPrev:		45.8	39.2	28.9	22.1	19.2	11.8	11.9	7.2	

Calculation Sheet

Yellow Bedroom Daytime LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Daytime Leq)										
Source dBA	54.0									
Octave Band Frequencies										
Leq,ff		58.0	56.0	52.0	50.0	50.0	46.0	41.0	35.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-37.4	-36.4	-39.4	-44.4	-43.4	-42.4	-41.4	-42.4	
Cumulative Lp										
Result		37.3	32.1	19.3	11.8	9.5	6.6	3.0	0.8	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Yellow										
Bedroom Daytime LAeq										
Reverberant Field, LPrev:		48.1	42.5	28.8	21.3	18.5	15.0	10.7	8.5	

Calculation Sheet

Yellow Bedroom Night-time LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Nighttime Leq)										
Source dBA	49.0									
Octave Band Frequencies										
Leq,ff		53.0	51.0	47.0	45.0	45.0	41.0	36.0	30.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-37.4	-36.4	-39.4	-44.4	-43.4	-42.4	-41.4	-42.4	
Cumulative Lp										
Result		32.3	27.1	14.4	7.3	5.5	3.3	1.2	0.3	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Yellow Bedroom Night-time LAeq Reverberant Field, LPrev:										
		43.1	37.5	23.9	16.9	14.5	11.7	8.9	8.0	

Calculation Sheet

Yellow Bedroom Night-time LAfmax

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime Lmax)									
Source dBA	69.0								
Octave Band Frequencies									
Leq,ff		73.0	71.0	67.0	65.0	65.0	61.0	56.0	50.0
		Row A							
Facade Wall Element									
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6
Facade Glazed Element									
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0
Facade Roof Element									
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4
Ventilators									
		-37.4	-36.4	-39.4	-44.4	-43.4	-42.4	-41.4	-42.4
Cumulative Lp									
Result		52.3	47.1	34.3	26.5	24.0	20.6	15.1	8.5
ISO 12354-3 Lfs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Yellow Bedroom Night-time LAfmax Reverberant Field, LPrev:		63.1	57.5	43.8	36.0	33.0	29.0	22.8	16.2

Calculation Sheet

Red Bedroom Daytime LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Daytime Leq)										
Source dBA	60.0									
Octave Band Frequencies										
Leq,ff		64.0	62.0	58.0	56.0	56.0	52.0	47.0	41.0	Row A
Facade Wall Element										
		-29.6	-34.6	-47.6	-55.6	-62.6	-68.6	-73.6	-75.6	
Facade Glazed Element										
		-38.0	-41.0	-46.0	-54.0	-57.0	-58.0	-50.0	-56.0	
Facade Roof Element										
		-37.4	-43.4	-57.4	-61.4	-68.4	-76.4	-76.4	-78.4	
Ventilators										
		-45.4	-44.4	-44.4	-47.4	-50.4	-58.4	-61.4	-64.4	
Cumulative Lp										
Result		35.7	29.1	17.1	10.5	7.5	1.8	1.9	0.2	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Red										
Bedroom Daytime LAeq										
Reverberant Field, LPrev:		46.4	39.4	26.6	20.0	16.5	10.2	9.6	7.9	

Calculation Sheet

Red Bedroom Night-time LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Nighttime Leq)										
Source dBA	52.0									
Octave Band Frequencies										
Leq,ff		56.0	54.0	50.0	48.0	48.0	44.0	39.0	33.0	Row A
Facade Wall Element										
		-29.6	-34.6	-47.6	-55.6	-62.6	-68.6	-73.6	-75.6	
Facade Glazed Element										
		-38.0	-41.0	-46.0	-54.0	-57.0	-58.0	-50.0	-56.0	
Facade Roof Element										
		-37.4	-43.4	-57.4	-61.4	-68.4	-76.4	-76.4	-78.4	
Ventilators										
		-45.4	-44.4	-44.4	-47.4	-50.4	-58.4	-61.4	-64.4	
Cumulative Lp										
Result		27.7	21.1	9.6	4.2	2.4	0.3	0.4	0.0	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Red										
Bedroom Night-time LAeq										
Reverberant Field, LPrev:		38.4	31.5	19.1	13.7	11.4	8.7	8.1	7.8	

Calculation Sheet

Red Bedroom Night-time L_Af_{max}

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime L_{max})									
Source dBA	78.0								
Octave Band Frequencies									
Leq,ff		82.0	80.0	76.0	74.0	74.0	70.0	65.0	59.0
		Row A							
Facade Wall Element									
		-29.6	-34.6	-47.6	-55.6	-62.6	-68.6	-73.6	-75.6
Facade Glazed Element									
		-38.0	-41.0	-46.0	-54.0	-57.0	-58.0	-50.0	-56.0
Facade Roof Element									
		-37.4	-43.4	-57.4	-61.4	-68.4	-76.4	-76.4	-78.4
Ventilators									
		-45.4	-44.4	-44.4	-47.4	-50.4	-58.4	-61.4	-64.4
Cumulative L_p									
Result		53.7	47.1	35.1	28.1	24.7	15.2	15.5	5.2
ISO 12354-3 L_fs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Red Bedroom Night-time L _A f _{max} Reverberant Field, L _{Prev} :		64.4	57.4	44.6	37.6	33.7	23.6	23.2	13.0

Calculation Sheet

Green Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	49.0									
Octave Band Frequencies										
Leq,ff		53.0	51.0	47.0	45.0	45.0	41.0	36.0	30.0	Row A
Facade Wall Element										
		-24.4	-27.4	-37.4	-43.4	-48.4	-52.4	-55.4	-59.4	
Facade Glazed Element										
		-25.2	-32.9	-38.1	-44.6	-48.3	-42.2	-56.8	-57.4	
Facade Roof Element										
		-26.0	-29.0	-39.0	-45.0	-50.0	-54.0	-57.0	-61.0	
Ventilators										
		-36.2	-37.2	-30.2	-40.2	-38.2	-37.2	-38.2	-39.2	
Cumulative Lp										
Result		32.7	26.8	18.6	8.8	8.4	6.3	2.1	0.5	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.1	9.5	8.7	8.7	8.7	8.3	7.9	6.8	
Internal Receiver Noise										
Internal Receiver Noise - Green Living Room										
Reverberant Field, LPrev:		42.8	36.2	27.3	17.5	17.2	14.6	10.0	7.3	

Calculation Sheet

Green Bedroom Daytime LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Daytime Leq)										
Source dBA	49.0									
Octave Band Frequencies										
Leq,ff		53.0	51.0	47.0	45.0	45.0	41.0	36.0	30.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-36.4	-37.4	-30.4	-40.4	-38.4	-37.4	-38.4	-39.4	
Cumulative Lp										
Result		32.3	27.1	18.3	8.5	8.2	5.7	2.0	0.5	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Green										
Bedroom Daytime LAeq										
Reverberant Field, LPrev:		43.1	37.4	27.8	18.1	17.2	14.1	9.8	8.2	

Calculation Sheet

Green Bedroom Night-time LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Nighttime Leq)										
Source dBA	45.0									
Octave Band Frequencies										
Leq,ff		49.0	47.0	43.0	41.0	41.0	37.0	32.0	26.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-36.4	-37.4	-30.4	-40.4	-38.4	-37.4	-38.4	-39.4	
Cumulative Lp										
Result		28.3	23.1	14.4	5.4	5.1	3.2	0.9	0.2	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Green										
Bedroom Night-time LAeq										
Reverberant Field, LPrev:		39.1	33.4	23.9	14.9	14.1	11.6	8.7	7.9	

Calculation Sheet

Green Bedroom Night-time L_Amax

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime L_{max})									
Source dBA	62.0								
Octave Band Frequencies									
Leq,ff		66.0	64.0	60.0	58.0	58.0	54.0	49.0	43.0
		Row A							
Facade Wall Element									
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6
Facade Glazed Element									
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0
Facade Roof Element									
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4
Ventilators									
		-36.4	-37.4	-30.4	-40.4	-38.4	-37.4	-38.4	-39.4
Cumulative L_p									
Result		45.3	40.0	31.2	20.9	20.5	17.4	11.1	5.2
ISO 12354-3 L_fs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Green Bedroom Night-time L _A max Reverberant Field, L _{Prev} :		56.1	50.4	40.7	30.4	29.5	25.8	18.9	13.0

Calculation Sheet

Yellow Living Room

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade									
Source dBA	54.0								
Octave Band Frequencies									
Leq,ff		58.0	56.0	52.0	50.0	50.0	46.0	41.0	35.0
Row A									
Facade Wall Element									
		-24.4	-27.4	-37.4	-43.4	-48.4	-52.4	-55.4	-59.4
Facade Glazed Element									
		-25.2	-32.9	-38.1	-44.6	-48.3	-42.2	-56.8	-57.4
Facade Roof Element									
		-26.0	-29.0	-39.0	-45.0	-50.0	-54.0	-57.0	-61.0
Ventilators									
		-34.2	-33.2	-36.2	-41.2	-40.2	-39.2	-38.2	-39.2
Cumulative Lp									
Result		37.8	32.1	20.5	12.9	11.6	9.3	4.7	1.4
ISO 12354-3 Lfs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.1	9.5	8.7	8.7	8.7	8.3	7.9	6.8
Internal Receiver Noise									
Internal Receiver Noise - Yellow Living Room									
Reverberant Field, LPrev:		47.9	41.6	29.2	21.7	20.3	17.6	12.6	8.2

Calculation Sheet

Red Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	53.0									
Octave Band Frequencies										
Leq,ff		57.0	55.0	51.0	49.0	49.0	45.0	40.0	34.0	Row A
Facade Wall Element										
		-24.4	-27.4	-37.4	-43.4	-48.4	-52.4	-55.4	-59.4	
Facade Glazed Element										
		-25.2	-32.9	-38.1	-44.6	-48.3	-42.2	-56.8	-57.4	
Facade Roof Element										
		-26.0	-29.0	-39.0	-45.0	-50.0	-54.0	-57.0	-61.0	
Ventilators										
		-35.2	-36.2	-39.2	-42.2	-42.2	-42.2	-41.2	-42.2	
Cumulative Lp										
Result		36.8	30.8	18.7	11.7	9.5	7.1	2.6	0.6	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.1	9.5	8.7	8.7	8.7	8.3	7.9	6.8	
Internal Receiver Noise										
Internal Receiver Noise - Red Living Room										
Reverberant Field, LPrev:		46.8	40.3	27.4	20.4	18.2	15.4	10.5	7.4	

Calculation Sheet

Yellow Bedroom Daytime LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Daytime Leq)										
Source dBA	54.0									
Octave Band Frequencies										
Leq,ff		58.0	56.0	52.0	50.0	50.0	46.0	41.0	35.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-37.4	-36.4	-39.4	-44.4	-43.4	-42.4	-41.4	-42.4	
Cumulative Lp										
Result		37.3	32.1	19.3	11.8	9.5	6.6	3.0	0.8	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Yellow										
Bedroom Daytime LAeq										
Reverberant Field, LPrev:		48.1	42.5	28.8	21.3	18.5	15.0	10.7	8.5	

Calculation Sheet

Yellow Bedroom Night-time LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Nighttime Leq)										
Source dBA	49.0									
Octave Band Frequencies										
Leq,ff		53.0	51.0	47.0	45.0	45.0	41.0	36.0	30.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-37.4	-36.4	-39.4	-44.4	-43.4	-42.4	-41.4	-42.4	
Cumulative Lp										
Result		32.3	27.1	14.4	7.3	5.5	3.3	1.2	0.3	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Yellow										
Bedroom Night-time LAeq										
Reverberant Field, LPrev:		43.1	37.5	23.9	16.9	14.5	11.7	8.9	8.0	

Calculation Sheet

Yellow Bedroom Night-time LAfmax

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime Lmax)									
Source dBA	69.0								
Octave Band Frequencies									
Leq,ff		73.0	71.0	67.0	65.0	65.0	61.0	56.0	50.0
		Row A							
Facade Wall Element									
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6
Facade Glazed Element									
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0
Facade Roof Element									
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4
Ventilators									
		-37.4	-36.4	-39.4	-44.4	-43.4	-42.4	-41.4	-42.4
Cumulative Lp									
Result		52.3	47.1	34.3	26.5	24.0	20.6	15.1	8.5
ISO 12354-3 Lfs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Yellow Bedroom Night-time LAfmax Reverberant Field, LPrev:		63.1	57.5	43.8	36.0	33.0	29.0	22.8	16.2

Calculation Sheet

Red Bedroom Daytime LAeq

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Daytime Leq)										
Source dBA	53.0									
Octave Band Frequencies										
Leq,ff		57.0	55.0	51.0	49.0	49.0	45.0	40.0	34.0	Row A
Facade Wall Element										
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6	
Facade Glazed Element										
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0	
Facade Roof Element										
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4	
Ventilators										
		-38.4	-39.4	-42.4	-45.4	-45.4	-45.4	-44.4	-45.4	
Cumulative Lp										
Result		36.3	31.0	17.9	10.6	7.8	4.7	1.5	0.3	
ISO 12354-3 Lfs Correction										
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Room Corrections										
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7	
Internal Receiver Noise										
Internal Receiver Noise - Red Bedroom Daytime LAeq Reverberant Field, LPrev:										
		47.1	41.4	27.4	20.1	16.8	13.1	9.3	8.1	

Calculation Sheet

Red Bedroom Night-time LAeq

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime Leq)									
Source dBA	44.0								
Octave Band Frequencies									
Leq,ff		48.0	46.0	42.0	40.0	40.0	36.0	31.0	25.0
Row A									
Facade Wall Element									
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6
Facade Glazed Element									
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0
Facade Roof Element									
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4
Ventilators									
		-38.4	-39.4	-42.4	-45.4	-45.4	-45.4	-44.4	-45.4
Cumulative Lp									
Result		27.3	22.0	9.3	3.7	2.1	0.9	0.2	0.0
ISO 12354-3 Lfs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Red Bedroom Night-time LAeq Reverberant Field, LPrev:									
		38.1	32.4	18.8	13.2	11.1	9.4	8.0	7.8

Calculation Sheet

Red Bedroom Night-time LAFmax

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Level at Facade (Nighttime Lmax)									
Source dBA	70.0								
Octave Band Frequencies									
Leq,ff		74.0	72.0	68.0	66.0	66.0	62.0	57.0	51.0
		Row A							
Facade Wall Element									
		-22.6	-25.6	-35.6	-41.6	-46.6	-50.6	-53.6	-57.6
Facade Glazed Element									
		-29.8	-37.5	-42.7	-49.2	-52.9	-46.8	-61.4	-62.0
Facade Roof Element									
		-27.4	-30.4	-40.4	-46.4	-51.4	-55.4	-58.4	-62.4
Ventilators									
		-38.4	-39.4	-42.4	-45.4	-45.4	-45.4	-44.4	-45.4
Cumulative Lp									
Result		53.3	48.0	34.8	27.2	24.0	19.9	13.5	7.0
ISO 12354-3 Lfs Correction									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Room Corrections									
		10.8	10.4	9.5	9.5	9.0	8.4	7.7	7.7
Internal Receiver Noise									
Internal Receiver Noise - Red Bedroom Night-time LAFmax Reverberant Field, LPrev:		64.1	58.4	44.3	36.7	33.0	28.3	21.2	14.7