



Noise Impact Assessment

Shelley Arms, Old Guildford Road,
Broadbridge Heath

Presented to: **Stonegate Pub Company Ltd**

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Report Details

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Executive Summary

<p>Site and Report Context</p>	<p>Delta-Simons Limited ('Delta-Simons') was instructed by Stonegate Pub Company Ltd (the 'Client') to prepare a Noise Impact Assessment in support of a planning application for a proposed residential development (the 'Proposed Development') located on land at the Shelley Arms, Old Guildford Road, Broadbridge Heath (the 'Site').</p> <p>This assessment has been undertaken to identify the key noise sources associated with the proposal and which may have the potential to impact the closest sensitive residential dwellings. Accordingly, this assessment has been completed with due regard to the National Planning Policy Framework (NPPF) and its associated Planning Policy Guidance (PPG), Professional Practice Guidance on Planning & Noise (ProPG) and BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'.</p>
<p>Summary</p>	<p>This assessment has been informed by a noise survey to quantify the existing background and ambient noise environment at the sensitive receptors.</p> <p>The ambient noise levels measured have encompassed the existing noise sources surrounding the proposed Site inclusive of the surrounding road traffic network and existing entertainment noise residing from the adjacent public house, The Shelley Arms. Therefore, the ambient noise levels measured at the worst-case Site boundaries are used to predict the likely internal noise levels for the proposed dwellings to establish the required façade mitigation strategy to not cause adverse noise impacts.</p> <p>The assessment has concluded that the predicted level of noise across the Site has low adverse impact on the proposed residential dwellings. A mitigation strategy of standard double glazing and a non-acoustic trickle vent has been used to demonstrate the predicted internal noise levels. Levels are within the stated BS 8233 internal ambient noise requirements.</p>
<p>Conclusion</p>	<p>The assessment has concluded that the predicted level of noise across the Site proposes a low adverse impact on the proposed residential dwellings and BS 8233 internal guideline ambient noise levels can be achieved, provided the following mitigation strategy is adopted as a minimum:</p> <ul style="list-style-type: none"> • Glazing rated at 35(-2;-6) dB R_w (C;Ctr); • Ventilation rated at 30(0;-1) dB D_{ne,W} (C;Ctr) <p>Measured noise levels suggest that ambient levels in the rear garden area would exceed the WHO guidelines for serious annoyance; inclusion of an acoustic barrier on the western boundary of the gardens would help to reduce ambient levels in the gardens.</p>
<p>This is intended as a summary only. Further detail and limitations of the assessment are provided within the main body of the Report.</p>	

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1.0 Introduction

1.1 Appointment

- 1.1.1 Delta-Simons Limited ('Delta-Simons') was instructed by Stonegate Pub Company (the 'Client') to prepare a Noise Impact Assessment to support a planning application for a proposed residential development, consisting of 4 dwellings (the 'Proposed Development'), located on land located on land at Shelley Arms, Old Guildford Road, Broadbridge Heath (the 'Site').

1.2 Site Location and Context

- 1.2.1 The Site is currently partly an unused patch of land, partly overflow car park to the rear of The Shelley Arms public house. The public house occasionally holds live music events on Fridays, Saturdays or Sundays in the later afternoon, and has an outside area bordering onto the Site, which has the potential to adversely impact the proposed dwellings. The pub operates during the following hours:

Table 1 - Pub Opening Hours

Day	Hours
Monday	15:00 - 21:00
Tuesday and Thursday	12:00 - 22:00
Wednesday, Friday and Saturday	12:00 - 23:00
Sunday	12:00 - 21:00

- 1.2.2 The dominating noise source in the area is considered to be road traffic noise, and existing extract plant is also audible.
- 1.2.3 It is proposed to submit a planning application for a residential development at the Site, consisting of 4 dwellings.
- 1.2.4 Reference should be made to **Figure 1** for a map of the Site and surrounding area.
- 1.2.5 The standard limitations associated with this assessment are presented in **Appendix A**.
- 1.2.6 A glossary of terms used in this report is provided in **Appendix B**.

2.0 Legislation and Policy

2.1 Planning Policy

2.1.1 A summary of the national and local planning policy relevant to the Proposed Development is provided below.

National Planning Policy Framework and Planning Practice Guidance

2.1.2 The Government published the revised National Planning Policy Framework (NPPF, 2023) and the Planning Practice Guidance (PPG) in July 2019¹. Together, the NPPF and PPG set out what the Government expects of local authorities. The overall aim is to ensure the planning system allows land to be used for new homes and jobs, while protecting valuable natural and historic environments.

2.1.3 The PPG adds further context to the NPPF and it is intended that the two documents should be read together.

2.1.4 Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

2.1.5 Local planning authorities' plan-making and decision making should 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.

2.1.6 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 (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

2.1.7 The Observed Effect Levels are as follows:

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

2.1.8 **Table 2** summarises the noise exposure hierarchy, based on the likely average response.

¹ Parts of PPG were updated in June 2021, however the Noise section was last updated in July 2019.

Table 2 - Noise Exposure Hierarchy

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

2.2 Local Planning Policy

Horsham District Planning Framework (excluding South Downs National Park), November 2015

2.2.1 The Horsham District Planning Framework (HDPF) is the overarching planning document for Horsham district outside the South Downs National Park, and replaces the Core Strategy and General Development Control Policies documents. This document sets out the planning strategy for the years up to 2031 to deliver the social, economic and environmental needs of the HDPF plan area.

2.2.2 Policy 24 'Strategic Policy: Environmental Protection' states:

"The high quality of the district's environment will be protected through the planning process and the provision of local guidance documents. Taking into account any relevant Planning Guidance Documents, developments will be expected to minimise exposure to and the emission of pollutants including noise, odour, air and light pollution and ensure that they:

[...]

4. Minimise the air pollution and greenhouse gas emissions in order to protect human health and the environment;

[...]"

2.2.3 Policy 33 'Development Principles' states:

"In order to conserve and enhance the natural and built environment developments shall be required to:
[...]

2. Ensure that it is designed to avoid unacceptable harm to the amenity of occupiers/users of nearby property and land, for example through overlooking or noise, whilst having regard to the sensitivities of surrounding development;

[...]"

2.3 Consultation

2.3.1 A consultation exercise was undertaken with Horsham District Council (HDC) on 18th July 2023 to discuss noise monitoring locations and assessment methodology. The consultation sent is provided below:

"Delta-Simons has been instructed to undertake a Noise Impact Assessment to support a planning application for a proposed residential development of 4 dwellings (the 'Proposed Development'), located on land adjacent to The Shelley Arms, Horsham (the 'Site'). From reviewing online mapping, the dominant noise sources on Site are likely to be road traffic noise from Old Guildford Road and A24, and the existing public house. A previous application for the Site (DC/18/1895) was approved, however, the permission has now lapsed. An up-to-date Noise Impact Assessment will be required for a new application. We are seeking Horsham District Council's (HDC) comments regarding our methodology.

Delta-Simons is proposing to undertake a baseline noise survey to establish existing background and ambient noise levels on and around the Site. Currently, it is anticipated this will involve one fixed measurement position representative of the Proposed Development and existing sensitive receptors, covering day and night periods for weekdays and weekends.

Baseline ambient noise levels obtained from the survey will be used to evaluate the impact of the existing noise sources on the Proposed Development in addition to establish appropriate glazing and ventilation specifications for habitable rooms across the Site to meet the day and night-time noise guidance presented in BS 8233:2014: 'Guidance on sound insulation and noise reduction for buildings'.

Where necessary, mitigation measures will be recommended to reduce noise impacts to acceptable levels.

Would HDC be happy with the above approach? If you have any further input, I look forward to your response.."

2.3.2 A response was received by email on 19th July 2023, from HDC's Environmental Protection Officer Kevin Beer stating:

"Thank you for your email and for running your noise monitoring proposals by us.

With regards to the existing public house - I don't believe we have received any noise complaints this summer yet, we have however received complaints in recent years in relation to outdoor music events. We would therefore like to see the assessment take this into account.

In terms of the monitoring of the road traffic noise - we would like to see the monitoring undertaken for long enough to capture the change in road traffic noise between weekdays and weekends (as opposed to 'spot' monitoring) and for long enough to capture diurnal distribution of road traffic noise during the day."

2.3.3 There was further communication with HDC following the baseline noise survey, however, it is more appropriate to detail this within Section 4.0 of this report.

2.4 Guidance

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

Noise Criteria Limits

- 2.4.1 The scope of this Standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.
- 2.4.2 The Standard suggests suitable internal noise levels within different types of buildings, including dwellings, as shown in **Table 3**.

Table 3 - BS 8233 Internal Target Noise Levels

Criterion	Typical Situation	Design $L_{Aeq,T}$ (dB)
Suitable resting / sleeping conditions	Living Room	35
	Bedroom*	30
*For a Reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not exceed 45dB L_{max}		

- 2.4.3 BS 8233 goes on to recommend noise levels for gardens as follows:

'It is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors might be warranted'.

- 2.4.4 BS 8233 goes on to say:

'In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited'.

Ventilation Requirements

- 2.4.5 Where a partially open window cannot be relied upon to provide an adequate level of façade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS 8233 states:

'The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used, and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

Alternatively, acoustic ventilation units (see comments on Section 7.7.2 of BS 8233 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.'

- 2.4.6 Section 7.7.2 of the Standard states:

'NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.'

Institute of Acoustics (IOA) 'Good Practice Guide on the Control of Noise from Pubs and Clubs'

2.4.7 The Institute of Acoustics 'Good Practice Guide on the Control of Noise from Pubs and Clubs' was published in March 2003 in order to provide guidance for the assessment and control of noise affecting noise-sensitive properties from the public and private use of public houses and clubs. Music, singing and speech, both amplified and non-amplified are common sources of noise disturbance arising from public houses. As far as these sources are concerned, the purpose of developing the objective noise criteria, should be to attempt to ensure that:

- For premises where entertainment takes place on a regular basis, music and associated sources should not be audible inside noise-sensitive property at any time.
- For premises where entertainment takes place less frequently, music and associated sources should not be audible inside noise-sensitive property between 23:00 and 07:00 hours.

2.4.8 For the purposes of this document, noise may be considered not audible or inaudible when it is at a low enough level such that it is not recognisable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question.

Professional Practice Guidance on Planning & Noise (ProPG)

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

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

2.4.11 It should be noted this document is not an official government code of practice, and neither replaces nor provides an authoritative interpretation of the law or government policy, and therefore should be seen as a good practice document only. The guidance presents a 2-phased assessment process.

Stage 1 - Initial Criteria

2.4.12 Stage 1 is an initial noise risk assessment of the proposed development site. This should ideally be undertaken as early as possible before any planning application is submitted. The noise risk assessment should indicate the likely risk of adverse effects from noise in the absence of any form of mitigation.

2.4.13 The noise risk assessment may be based on measurement or prediction, as appropriate and should aim to describe noise levels over a "typical worst case" 24-hour day either now or in the foreseeable future.

2.4.14 The Indicative Daytime ($L_{Aeq,16hr}$) and Indicative Night-time ($L_{Aeq,8hr}$) noise levels for each category are shown in **Table 4**. which is extracted from Figure 1 in ProPG. These are combined free-field noise levels from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant". The indicative noise levels provide an indication of the noise effect 'challenge' at a potential residential development site.

2.4.15 The table below summarises the Stage 1 assessment.

Table 4 - ProPG Stage 1: Initial Site Noise Risk Assessment

Indicative Noise Levels dB		Risk Level	Potential Effect Without Noise Mitigation	Pre-planning Application Advice
Daytime L _{Aeq,16h}	Night-time L _{Aeq,8h}			
70	60	High	 Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed Acoustic Design Statement (ADS). Applicants are strongly advised to seek expert advice.
65	55	Medium		As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
60	50	Low		At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
55	45	Low		
50	40	Negligible	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds

2.4.16 It is strongly expressed in ProPG that the noise risk assessment outcome identified at a potential development site is “not the basis for an eventual recommendation to the decision maker”, but an opportunity for good acoustic design to be incorporated from the onset of the design process. A site considered to be high risk will be recognised as having more acoustic challenges, and a site defined with negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds.

2.4.17 Regarding L_{AFmax} levels, paragraph A.19 notes:

“...the effects of noise on sleep from individual noise events are an important consideration; and that the initial site noise risk assessment should include the consideration of the individual noise events when the external L_{Amax,F} exceeds 60 dB. A site should not be regarded as negligible risk if the L_{Amax,F} exceeds, or is likely to exceed 60 dB more than 10 times a night. A site should be regarded as high risk if the L_{Amax,F} exceeds, or is likely to exceed 80 dB more than 20 times a night.”

Stage 2 - Full Assessment

2.4.18 There are four key elements to Stage 2. These are:

- 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'.

Element 1 - Good Acoustic Design

- 2.4.19 Good acoustic design does not mean overdesigning a new development but seeking to deliver the optimum acoustic outcome for a particular site. It is not just compliance with recommended internal and external noise levels, but should provide a solution to achieve the optimum acoustic outcome without design compromises that will adversely affect living conditions, quality of life, or other sustainable design objectives and requirements
- 2.4.20 Planning applications for new residential developments should consider the following aspects of good acoustic design:
- Check the feasibility of relocating, or reducing noise levels from relevant sources;
 - Consider options for planning the site or building layout;
 - Consider the orientation of proposed building(s);
 - Select construction types and methods for meeting building performance requirements;
 - Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
 - Assess the viability of alternative solutions; and
 - Assess external amenity area noise.

Element 2 - Internal Noise Level Guidelines

- 2.4.21 The element seeks to achieve recommended noise levels inside noise sensitive rooms in new residential development. Guideline levels can be found in BS 8233 and are set out in Table 3.
- 2.4.22 Care should be taken when specifying very high façade sound insulation in order to reduce the level of internal noise from external sources, as this may also reduce the extent to which a low level of steady external noise can help to mask any noise from neighbours.

Element 3 - External Amenity Area Noise Assessment

- 2.4.23 ProPG quotes BS 8233 regarding external amenity. The quote is set out in paragraph 2.4.3 of this Report.
- 2.4.24 PPG Noise is also quoted:

'If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.'

- 2.4.25 ProPG extends these guidelines to cover scenarios where recommended levels cannot be achieved, despite good acoustic design.

Element 4 - Assessment of Other Relevant Issues

- 2.4.26 This element seeks to build upon relevant national and local planning and noise policies to provide recommendations for the issues that should be considered before any planning application is determined.

World Health Organization (WHO) Guidelines for Community Noise 1999

- 2.4.27 Published by the WHO in 2000, this document was prepared as a response to a need for action together with a generic need for improvements in legislation at a national level.

2.4.28 The document provides guideline sound levels in specific human environments. There is also information on the likely 'critical health effects' associated with sound levels exceeding the guideline values. The guideline values for ambient sound levels ($L_{Aeq,T}$) and maximum sound levels (L_{AFmax}) that are relevant in this case are set out in **Table 5**.

Table 5 - WHO Guidelines levels

Specific Environment	Critical Health Effect	dB L_{Aeq}	Time Base, hours	dB L_{AFmax}
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance night-time	30	8	45*
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60*

*With regard to the assessment of maximum sound levels, it is suggested in Section 3.4 of the WHO Guidelines that the L_{AFmax} levels shown in this table should not be exceeded more than 10-15 times per night.

3.0 Scope and Methodology

3.1 Scope

3.1.1 The scope of the assessment has been determined in the following way:

- Undertake a baseline noise survey over a weekday and weekend period to establish existing ambient and background noise levels from nearby sources on and around the Site;
- Assess the likely noise impact of the existing public house and road network upon the development; and
- Provide advice for suitable mitigation for the proposed development.

3.2 BS 8233 Assessment

3.2.1 Noise levels measured at the Site boundary, inclusive of The Shelley Arms and the surrounding road network, were used to consider the noise exposure to future sensitive dwellings.

3.2.2 The noise levels have informed calculations to determine glazing and ventilation specifications for habitable rooms.

3.3 Existing Pub Entertainment Noise

3.3.1 Opening hours of The Shelley Arms are understood to typically be as set out in **Table 1**:

3.3.2 Therefore there is not potential for entertainment noise from the business during the night-time hours. On review of the Institute of Acoustics (IOA) 'Good Practice Guide on the Control of Noise from Pubs and Clubs', referenced within the guidance note, Section 2.4 states regarding entertainment noise that:

"For premises where entertainment takes place less frequently, music and associated sources should not be audible inside noise-sensitive property between 23:00 and 07:00 hours."

3.3.3 A review of advertised live music events on the public house's Facebook page shows that events may occur every 1-2 weeks, all of which are late afternoon into early evening. However, there are many weeks in a row where no events are advertised..

3.3.4 Analysis of audio recordings taken during the baseline survey has shown that no music noise was audible at the measurement location. Patrons using the beer garden were audible during the evening period, with traffic noise and birdsong dominating at other times. Section 2.4 of the IOA document states:

"For the purposes of this document, noise may be considered not audible or inaudible when it is at low enough level such that it is not recognisable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question."

3.3.5 During the baseline noise survey road traffic and plant noise was generally the dominant source, however, noise from patrons of the pub was audible during the afternoon and evening period.

4.0 Baseline Noise Survey

4.1 Measurement Locations

4.1.1 Measurements were undertaken at the following locations

Table 6 - Measurement Locations

Measurement Location	British National Grid Coordinates		Date and Time	Observations
	X	Y		
L1	5151701	131538	21 st July 2023 15:15 to 22 nd July 2023 15:20	Plant from pub audible, road traffic noise, people talking in gardens.

4.1.2 Noise monitoring locations are shown in **Figure 1**.

4.2 Noise Measurement Equipment

4.2.1 The following noise monitoring equipment was used throughout the survey. Measurements were taken in general accordance with BS 7445-1:2003 'The Description and Measurement of Environmental Noise: Guide to quantities and procedures.

Table 7 - Noise Measurement Equipment

Measurement Position	Equipment	Model Type	Serial Number	Last Laboratory Calibration before Survey Date
L1	Sound Level Meter	Fusion 01dB	14146	11 th October 2021
	Pre-amplifier	01dB PRE22	2113236	
	Microphone	GRAS 40CD	466819	
	Calibrator	CR:515	95399	13 th April 2022

4.2.2 The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice. Calibration certificates for which are available on request.

4.3 Weather Conditions

4.3.1 Weather conditions during the survey period were dry with wind speeds below 5m/s.

4.4 Survey Summary Results

4.4.1 The table below summarises the measured data. A graphical representation of the survey data is shown in **Figure 2**

Table 8 - L1 Survey Summary Results

Period	L _{Aeq,T} dB	L _{AFmax,T} dB	10 th Highest L _{AFmax}	L _{A10,T} dB	L _{A90,T} dB
Daytime (07:00 -23:00)	57.0	83.0	-	55.3	50.1
Night-time (23:00-07:00)	42.2	72.8	64.1	41.3	35.8

- 4.4.2 During the survey set-up and collection, there was traffic audible on Old Guildford Road, which was considered to be the dominant source. Extract plant from the pub was audible but not dominant. Analysis of audio recordings shows that the dominant source during the between 15:30 and 21:00 on 21st July 2023 was a generator associated with the bouncy castle in the pub beer garden.
- 4.4.3 No people were in the pub beer garden during setup and collection; however, analysis of audio recordings has showed people using the beer garden were audible during the survey, but distinct conversations were not audible.
- 4.4.4 During the survey, the monitoring equipment was tampered with by members of the public, and stopped recording data at 15:20 on 22nd July 2023. Following this, further discussions were had with the EHO at HDC regarding the levels measured and the duration of the survey. Comparisons were made with previous measurements undertaken at the Site in 2018 (further details on this below). These discussions concluded with HDC noting that *"Although shorter than we would have liked we are broadly happy with the monitoring that has been undertaken"* and requesting *"commentary in the report in relation to the L_{Amax} levels at night"*.
- 4.4.5 A baseline noise survey was undertaken for a previous application at the Site in June 2018. The table below details the measured data from that survey.

Table 9 - Previous Survey Summary Results

Date	Period	L _{Aeq,T} dB	L _{AFmax,T} dB
20th - 21st June 2018	Daytime (07:00 -23:00)	58.1	78.2
	Night-time (23:00-07:00)	50.6	71.7
21st - 22nd June 2018	Daytime (07:00 -23:00)	58.4	78.4
	Night-time (23:00-07:00)	50.2	71.0
22nd - 23rd June 2018	Daytime (07:00 -23:00)	57.8	77.4
	Night-time (23:00-07:00)	49.5	73.5
23rd - 24th June 2018	Daytime (07:00 -23:00)	56.4	82.2
	Night-time (23:00-07:00)	47.6	69.4
24th - 25th June 2018	Daytime (07:00 -23:00)	55.1	76.8
	Night-time (23:00-07:00)	48.3	68.5
Overall	Daytime (07:00 -23:00)	57.3	82.2
	Night-time (23:00-07:00)	49.4	73.5

- 4.4.6 Comparing measured levels between the two noise surveys generally shows good correlation, although the Delta-Simons measured night-time L_{Aeq,T} levels are slightly lower; as a worst case, night time L_{Aeq,T} levels from the previous noise survey will be used to specify glazing and ventilation requirements for bedrooms.

5.0 Assessment

5.1 ProPG Initial Assessment

- 5.1.1 Noise levels at the Site were measured as being 57dB L_{Aeq} during the daytime and 49dB L_{Aeq}^2 at night.
- 5.1.2 The measured data shows that L_{AFmax} exceeds 60dB L_{AFmax} 22 times during the night-time period, so the Site cannot be classified as 'negligible' risk. However, there are no L_{AFmax} levels above 80dB L_{AFmax} , and therefore the Site does not need to be classified as 'High' risk.
- 5.1.3 The measured noise levels indicate that the Site is '**Low**' risk. This indicates the Site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS.

5.2 BS 8233 Assessment

Habitable rooms

- 5.2.1 To assess the potential glazing and ventilation requirements for the proposed dwellings, noise ingress calculations have been undertaken. To inform the calculations, the internal room measurements from the Proposed Development illustrative Site layout and elevations have been used, undertaking separate calculations for each bedroom and living room. **Appendix C** details the dimensions used in the calculations.

Predicted Noise levels

- 5.2.2 **Table 10** summarises the predictions of internal noise levels at the worst-case boundaries across the development site and their significance against the BS 8233 criteria with the façade treatment elements in place.
- 5.2.3 Regarding the L_{AFmax} levels, there were a few from transportation sources late on the Friday (21st July) night, however the majority of L_{Amax} events occurred during the early morning period on the Saturday (22nd July) and were predominantly from wildlife sources³. The 10th highest measured night-time L_{AFmax} event noise level from location L1 is used to inform the noise ingress calculations.
- 5.2.4 Noise ingress calculations are provided in **Appendix C**.

Table 10 - Noise Predicted Results

Apartment Type	Room	Period	BS 8233 Internal Ambient Noise Requirements, dB	Predicted Ambient Internal Noise Level, dB	Façade Mitigation Strategy
Plots 1 and 4	Living Room	Daytime	35 L_{Aeq}	30 L_{Aeq}	1
	Bedroom 1	Night-time	30 L_{Aeq}	30 L_{Aeq}	1
			45 L_{Amax}	41 L_{Amax}	
	Bedroom 2	Night-time	30 L_{Aeq}	27 L_{Aeq}	1
			45 L_{Amax}	40 L_{Amax}	
	Bedroom 3	Night-time	30 L_{Aeq}	27 L_{Aeq}	1
45 L_{Amax}			41 L_{Amax}		
Plots 2 and 3	Living Room	Daytime	35 L_{Aeq}	31 L_{Aeq}	1
	Bedroom 1	Night-time	30 L_{Aeq}	27 L_{Aeq}	1

² From the 2018 noise survey

³ Identified through analysing audio recordings

Apartment Type	Room	Period	BS 8233 Internal Ambient Noise Requirements, dB	Predicted Ambient Internal Noise Level, dB	Façade Mitigation Strategy
			45 L _{Amax}	39 L _{Amax}	
	Bedroom 2	Night-time	30 L _{Aeq}	26 L _{Aeq}	1
			45 L _{Amax}	39 L _{Amax}	

5.2.5 It can be seen in the above table that internal noise limit criteria for the day and night periods would be achieved with a standard façade mitigation strategy, as set out below in **Table 11**.

Table 11 - Façade Mitigation Strategy

Façade Mitigation Strategy	Item	Sound Insulation Specification dB	Example product*
1	Glazing	35(-2;-6) dB R _w (C;Ctr)	Glass Systems 8/(6-16)/6 Double Glazed Unit
	Ventilation	30(0;-1) dB D _{ne,W} (C;Ctr)	Greenwood HD Vent 8000HD

Products provided are an example that meets the required specification. Other products from different manufacturers may be available that meet the required specification. Inclusion in this table does not constitute and endorsement by Delta-Simons.

5.2.6 The specified façade mitigation strategies in the table above do not represent anything unusual and can be met using a fairly standard double-glazing sets and off-the-shelf slot vents which are available from several manufacturers.

5.2.7 Glazing should be in accordance with the specified glazing in **Table 11** or of an equivalent acoustic performance. Note that it must be ensured that the sound insulation of the glazing is not compromised by the selected frames. Frames should also be sealed within the building opening using an appropriate acoustic sealant with any large cavities packed with dense mineral wool prior to sealing the surface with appropriate mastic or acoustic sealant. Expanding light-weight foam type fillers should not be used to fill large voids behind weather protection.

5.2.8 Please note that the specification of vents is in terms of acoustic performance only. It should be checked by others that the ventilation requirements of the Building Regulations are also met.

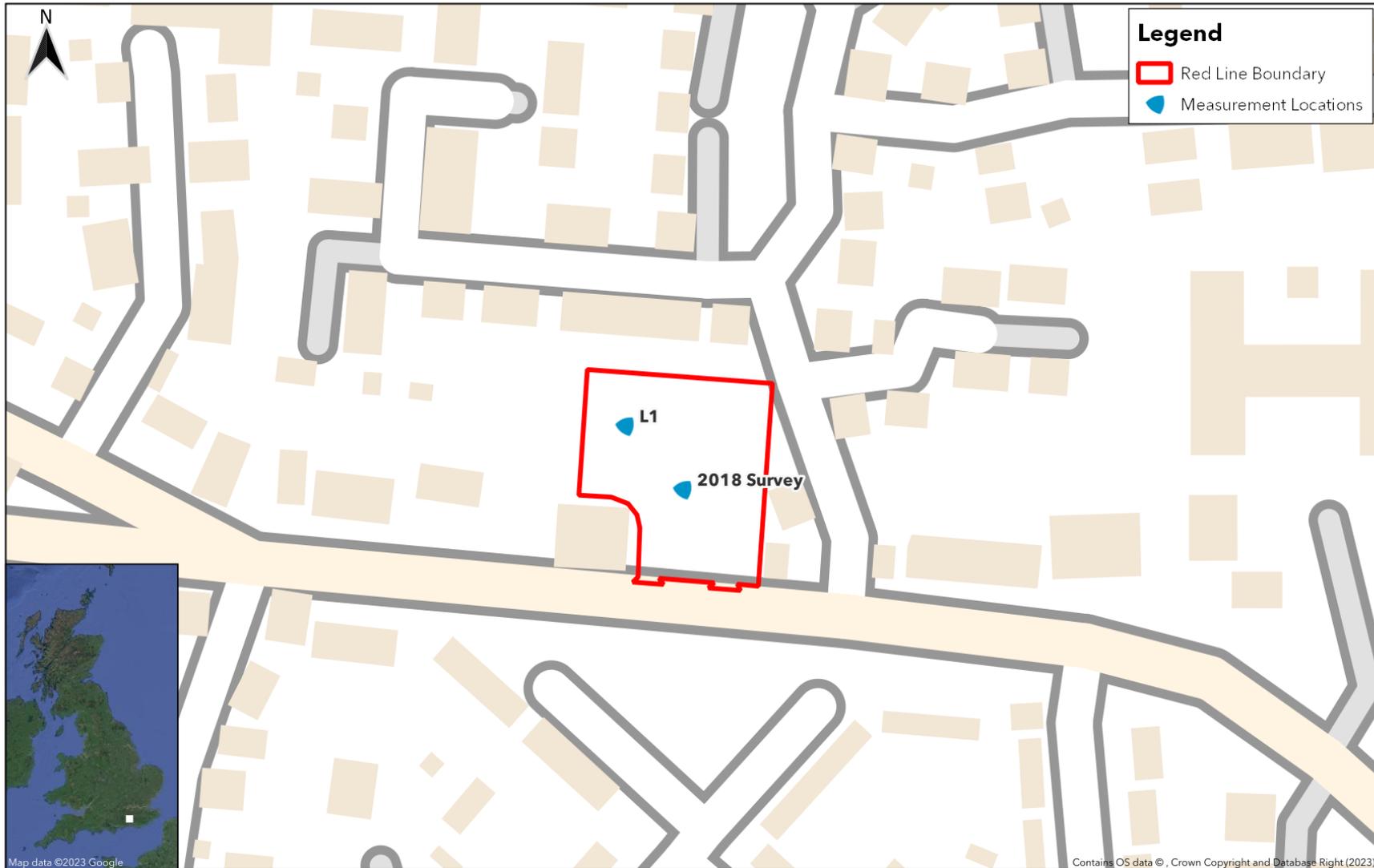
5.3 External Amenity

5.3.1 Measured daytime ambient noise levels during the survey were 57dB L_{Aeq,16hr}. This exceeds the WHO guideline for serious annoyance, and therefore it may be beneficial to include an acoustic barrier along the western boundary of the rear gardens. This would help to reduce ambient noise levels in the garden. Any barriers installed should be constructed from continuous overlapped panels with a minimum surface density of 12kg/m².

6.0 Summary and Conclusions

- 6.1.1 Delta-Simons Limited ('Delta-Simons') was instructed by Stonegate Pub Company Ltd (the 'Client') to prepare a Noise Impact Assessment in support of a planning application for a proposed residential development (the 'Proposed Development') located on land at the Shelley Arms, Old Guildford Road (the 'Site').
- 6.1.2 It is proposed to submit planning application for a residential development at the Site, consisting of four dwellings.
- 6.1.3 This assessment has been undertaken to identify the key noise sources associated with the proposal and which may have the potential to impact the closest sensitive residential dwellings. Accordingly, this assessment has been completed with due regard to:
- National Planning Policy Framework (NPPF);
 - Planning Policy Guidance (PPG);
 - Professional Practice Guidance on Planning & Noise (ProPG); and
 - BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'.
- 6.1.4 This assessment has been informed by a noise survey, completed over a weekday and weekend period, to quantify the existing background noise environment at the sensitive receptors.
- 6.1.5 The assessment has concluded that the predicted level of noise across the Site poses a **low adverse impact** on the proposed residential dwellings and BS 8233 internal guideline ambient noise levels can be achieved, provided the mitigation strategies set out in **Table 11** are adopted as a minimum.
- 6.1.6 Measured noise levels suggest that ambient levels in the rear garden area would exceed the WHO guidelines for serious annoyance; inclusion of an acoustic barrier on the western boundary of the garden would help to reduce ambient levels in the garden.

Figure 1 - Proposed Site and Measurement Locations

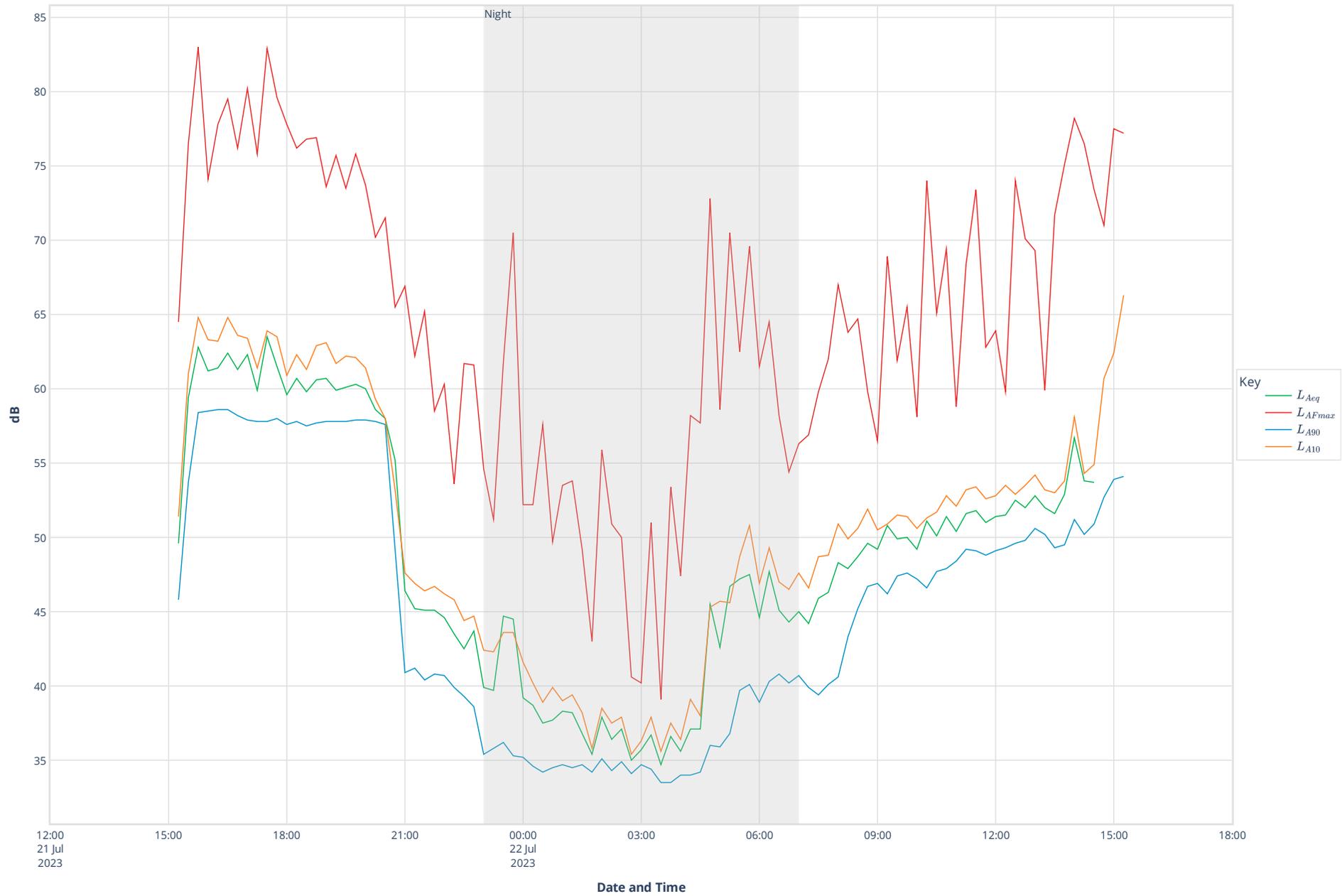


DeltaSimons
Protecting people and planet

TITLE: Site Location and Measurement Location

DRAWN BY:	DB	SCALE at A4:	1:1292	PROJECT NO.:	99339.584194
CHECKED BY:	DP	REVISION:	0	FIGURE NO.:	1
DATE:	13 Sep 2023				

Figure 2 - L1 Long Term Measurement Time History



Appendix A - Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B - Glossary

Glossary

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table B1 - Typical Sound Pressure Levels

Sound Pressure Level (dB)	Location/Example
0	Threshold of hearing
20 - 30	Quiet bedroom at night
30 - 40	Living room during the day
40 - 50	Typical office
50 - 60	Inside a car
60 - 70	Typical high street
70 - 90	Inside factory
100 - 110	Burglar alarm at 1m away
110 - 130	Jet aircraft on take off
140	Threshold of pain

Table B2 - Terminology

Descriptor	Explanation
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
C and Ctr	Correction terms applied against a sound insulation single-number value (e.g. $D_{nT,w}$ or R_w) to provide a weighting against low frequency performance. C is the A-weighted pink noise spectrum. Ctr is the A-weighted urban traffic noise spectrum.
$D_{nT,w}$	A single-number quantity that characterizes the airborne sound insulation between spaces.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Façade level	The sound pressure level as measured at 1m in front of a building façade or any acoustically reflective surface, other than the ground.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
R_w	A weighted sound reduction index - laboratory measurement.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

Appendix C - Façade Break-in Calculations

Table C1 - Habitable Rooms: Ground floor

Room / Item	Parameter	Value / description
Plot 1 and 4 Living Room	Length (m)	6.2
	Width (m)	5.1
	Height (m)	2.7
	Total External Façade Area (m ²)	30.5
	Volume (m ³)	85.4
	Glazed Area (m ²)	3.2
Plot 1 and 4 Bedroom 1	Length (m)	3.2
	Width (m)	3.3
	Height (m)	2.7
	Total External Façade Area (m ²)	17.6
	External Roof Area (m ²)	10.6
	Volume (m ³)	28.5
	Glazed Area (m ²)	8.0
Plot 1 and 4 Bedroom 2	Length (m)	4.5
	Width (m)	2.8
	Height (m)	2.7
	Total External Façade Area (m ²)	19.7
	External Roof Area (m ²)	12.6
	Volume (m ³)	34.0
	Glazed Area (m ²)	1.6
Plot 1 and 4 Bedroom 3		4.5
		2.3
		2.7
		6.2
		10.4
		27.9
		1.0
Plot 1 and 4 Living Room	Length (m)	5.2
	Width (m)	4.9
	Height (m)	2.7
	Total External Façade Area (m ²)	27.3
	Volume (m ³)	68.8
	Glazed Area (m ²)	2.7
Plot 2 and 3 Bedroom 1	Length (m)	4.8
	Width (m)	3.0
	Height (m)	2.7
	Total External Façade Area (m ²)	21.1
	External Roof Area (m ²)	14.4

Room / Item	Parameter	Value / description
	Volume (m ³)	38.9
	Glazed Area (m ²)	2.1
Plot 2 and 3 Bedroom 2	Length (m)	4.8
	Width (m)	3.4
	Height (m)	2.7
	Total External Façade Area (m ²)	22.1
	External Roof Area (m ²)	16.3
	Volume (m ³)	44.1
	Glazed Area (m ²)	2.0
Façade	Construction	Solid, with brick/block cavity wall
Roof	Construction	Tiled/slatted roof, 25mm plasterboard ceiling, 100mm mineral wool
Internal Finishes	-	'Normal' e.g. carpets etc

Table C2 - Habitable Rooms: First floor

Room / Item	Parameter	Value / description
Living Room	Length (m)	3.2
	Width (m)	6.8
	Height (m)	2.8
	Total External Façade Area (m ²)	36.4
	External Roof Area (m ²)	21.8
	Volume (m ³)	60.9
	Glazed Area (m ²)	1.8
Bedroom 1	Length (m)	4.7
	Width (m)	3.3
	Height (m)	2.8
	Total External Façade Area (m ²)	13.2
	External Roof Area (m ²)	15.5
	Volume (m ³)	43.4
	Glazed Area (m ²)	1.7
Bedroom 2	Length (m)	4.8
	Width (m)	2.8
	Height (m)	2.8
	Total External Façade Area (m ²)	14.3
	External Roof Area (m ²)	13.4
	Volume (m ³)	37.6
	Glazed Area (m ²)	1.3
Façade	Construction	Solid, with brick/block cavity wall
Roof	Construction	Tiled/slatted roof, 25mm plasterboard ceiling, 100mm mineral wool
Internal Finishes	-	'Normal' e.g. carpets etc

Plots 1 & 2: Living Room

Façade Noise Break-In Calculation					 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Living Room											
Room Type:	Living Room											
Volume m³	85.4											
Façade Area m²	30.5											
					Frequency, Hz							
					125	250	500	1000	2000	4000	dB(A)	
Room Information	Reverberation Time, sec				0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A				27.8	27.8	27.8	27.8	27.8	27.8		
	10*log(S/A)				0.4	0.4	0.4	0.4	0.4	0.4		
Incident Noise Level, dB					58.1	56.2	50.7	51.4	51.0	47.4	57.0	
Safety Factor, dB					3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements												
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit			R _w	20.0	21.0	33.0	40.0	36.0	48.0	
	3.2	Area correction			dB	-29.8	-30.8	-42.8	-49.8	-45.8	-57.8	
	Predicted noise level in building from glazing					dB	34.7	31.8	14.3	8.0	11.6	-4.0
Solid Façade	Area m²	Brick/block cavity wall			R _w	41.0	45.0	45.0	54.0	58.0	58.0	
	27.3	Area correction			dB	-41.5	-45.5	-45.5	-54.5	-58.5	-58.5	
	Predicted noise level through solid façade					dB	23.0	17.1	11.6	3.3	-1.1	-4.7
Ventilation	Greenwood HD Vent 8000HD				D _{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction				dB	-37.4	-36.4	-33.9	-33.2	-34.9	-38.3	
	Predicted noise level through vent					dB	27.0	26.1	23.1	24.5	22.4	15.4
Combined Noise Level (Glazing+Solid Façade+Ventilation)						35.6	33.0	23.9	24.7	22.8	15.5	30.3
										Target dB(A) Level	35	
										Pass/Fail	Pass	

Plots 1 & 2: Bedroom 1 L_{Aeq}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Bedroom 1										
Room Type:	Bedroom (night-time)										
Volume m³	28.5										
Façade Area m²	17.6										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			9.3	9.3	9.3	9.3	9.3	9.3		
	10*log(S/A)			2.8	2.8	2.8	2.8	2.8	2.8		
Incident Noise Level, dB				50.7	48.1	48.0	43.1	40.5	38.9	49.4	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R_w	20.0	21.0	33.0	40.0	36.0	48.0	
	8.0	Area correction		dB	-23.4	-24.4	-36.4	-43.4	-39.4	-51.4	
	Predicted noise level in building from glazing		dB		36.1	32.5	20.4	8.5	9.9	-3.7	26.2
Solid Façade	Area m²	Brick/block cavity wall		R_w	41.0	45.0	45.0	54.0	58.0	58.0	
	9.6	Area correction		dB	-43.6	-47.6	-47.6	-56.6	-60.6	-60.6	
	Predicted noise level through solid façade		dB		15.8	9.2	9.1	-4.8	-11.4	-13.0	8.2
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R_w	24.0	34.0	40.0	45.0	49.0	49.0	
	10.6	Area correction		dB	-26.2	-36.2	-42.2	-47.2	-51.2	-51.2	
	Predicted noise level through vent		dB		33.3	20.7	14.6	4.7	-1.9	-3.5	19.4
Ventilation	Greenwood HD Vent 8000HD			D_{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-35.1	-34.1	-31.6	-30.9	-32.6	-36.0	
	Predicted noise level through vent		dB		24.4	22.8	25.2	21.0	16.7	11.7	26.0
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					38.1	33.2	26.8	21.4	17.6	12.0	29.6
Target dB(A) Level										30	
Pass/Fail										Pass	

Plots 1 & 2: Bedroom 1 L_{AFmax}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Bedroom 1										
Room Type:	Bedroom (Lmax)										
Volume m³	28.5										
Façade Area m²	17.6										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			9.3	9.3	9.3	9.3	9.3	9.3		
	10*log(S/A)			2.8	2.8	2.8	2.8	2.8	2.8		
Incident Noise Level, dB				50.7	55.1	61.9	56.8	52.4	59.3	64.1	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R _w	20.0	21.0	33.0	40.0	36.0	48.0	
	8.0	Area correction		dB	-23.4	-24.4	-36.4	-43.4	-39.4	-51.4	
	Predicted noise level in building from glazing				dB	36.1	39.5	34.3	22.2	21.8	16.7
Solid Façade	Area m²	Brick/block cavity wall		R _w	41.0	45.0	45.0	54.0	58.0	58.0	
	9.6	Area correction		dB	-43.6	-47.6	-47.6	-56.6	-60.6	-60.6	
	Predicted noise level through solid façade				dB	15.8	16.2	23.0	8.9	0.5	7.4
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R _w	24.0	34.0	40.0	45.0	49.0	49.0	
	10.6	Area correction		dB	-26.2	-36.2	-42.2	-47.2	-51.2	-51.2	
	Predicted noise level through vent				dB	33.3	27.7	28.5	18.4	10.0	16.9
Ventilation	Greenwood HD Vent 8000HD			D _{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-35.1	-34.1	-31.6	-30.9	-32.6	-36.0	
	Predicted noise level through vent				dB	24.4	29.8	39.1	34.7	28.6	32.1
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					38.1	40.2	40.7	35.1	29.5	32.4	41.4
Target dB(A) Level										45	
Pass/Fail										Pass	

Plots 1 & 2: Bedroom 2 L_{Aeq}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Bedroom 2										
Room Type:	Bedroom (night-time)										
Volume m³	34.0										
Façade Area m²	19.7										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			11.1	11.1	11.1	11.1	11.1	11.1		
	10*log(S/A)			2.5	2.5	2.5	2.5	2.5	2.5		
Incident Noise Level, dB				50.7	48.1	48.0	43.1	40.5	38.9	49.4	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R_w	20.0	21.0	33.0	40.0	36.0	48.0	
	1.6	Area correction		dB	-30.9	-31.9	-43.9	-50.9	-46.9	-58.9	
	Predicted noise level in building from glazing		dB		28.3	24.7	12.6	0.7	2.1	-11.5	18.4
Solid Façade	Area m²	Brick/block cavity wall		R_w	41.0	45.0	45.0	54.0	58.0	58.0	
	18.1	Area correction		dB	-41.4	-45.4	-45.4	-54.4	-58.4	-58.4	
	Predicted noise level through solid façade		dB		17.8	11.2	11.1	-2.8	-9.4	-11.0	10.1
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R_w	24.0	34.0	40.0	45.0	49.0	49.0	
	12.6	Area correction		dB	-25.9	-35.9	-41.9	-46.9	-50.9	-50.9	
	Predicted noise level through vent		dB		33.3	20.7	14.6	4.7	-1.9	-3.5	19.4
Ventilation	Greenwood HD Vent 8000HD			D_{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-35.5	-34.5	-32.0	-31.3	-33.0	-36.4	
	Predicted noise level through vent		dB		23.7	22.1	24.5	20.3	16.0	11.0	25.3
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					34.9	27.7	25.3	20.4	16.2	11.2	27.0
Target dB(A) Level										30	
Pass/Fail										Pass	

Plots 1 & 2: Bedroom 2 L_{AFmax}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Bedroom 2										
Room Type:	Bedroom (Lmax)										
Volume m³	34.0										
Façade Area m²	19.7										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			11.1	11.1	11.1	11.1	11.1	11.1		
	10*log(S/A)			2.5	2.5	2.5	2.5	2.5	2.5		
Incident Noise Level, dB				50.7	55.1	61.9	56.8	52.4	59.3	64.1	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R _w	20.0	21.0	33.0	40.0	36.0	48.0	
	1.6	Area correction		dB	-30.9	-31.9	-43.9	-50.9	-46.9	-58.9	
	Predicted noise level in building from glazing		dB		28.3	31.7	26.5	14.4	14.0	8.9	27.0
Solid Façade	Area m²	Brick/block cavity wall		R _w	41.0	45.0	45.0	54.0	58.0	58.0	
	18.1	Area correction		dB	-41.4	-45.4	-45.4	-54.4	-58.4	-58.4	
	Predicted noise level through solid façade		dB		17.8	18.2	25.0	10.9	2.5	9.4	22.8
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R _w	24.0	34.0	40.0	45.0	49.0	49.0	
	12.6	Area correction		dB	-25.9	-35.9	-41.9	-46.9	-50.9	-50.9	
	Predicted noise level through vent		dB		33.3	27.7	28.5	18.4	10.0	16.9	27.9
Ventilation	Greenwood HD Vent 8000HD			D _{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-35.5	-34.5	-32.0	-31.3	-33.0	-36.4	
	Predicted noise level through vent		dB		23.7	29.1	38.4	34.0	27.9	31.4	39.3
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					34.9	34.7	39.2	34.1	28.1	31.6	39.9
Target dB(A) Level										45	
Pass/Fail										Pass	

Plots 1 & 2: Bedroom 3 L_{Aeq}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Bedroom 3										
Room Type:	Bedroom (night-time)										
Volume m³	27.9										
Façade Area m²	6.2										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			9.1	9.1	9.1	9.1	9.1	9.1		
	10*log(S/A)			-1.7	-1.7	-1.7	-1.7	-1.7	-1.7		
Incident Noise Level, dB				50.7	48.1	48.0	43.1	40.5	38.9	49.4	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R_w	20.0	21.0	33.0	40.0	36.0	48.0	
	1.0	Area correction		dB	-27.9	-28.9	-40.9	-47.9	-43.9	-55.9	
	Predicted noise level in building from glazing		dB		27.1	23.5	11.4	-0.5	0.9	-12.7	17.2
Solid Façade	Area m²	Brick/block cavity wall		R_w	41.0	45.0	45.0	54.0	58.0	58.0	
	5.2	Area correction		dB	-41.8	-45.8	-45.8	-54.8	-58.8	-58.8	
	Predicted noise level through solid façade		dB		13.3	6.7	6.6	-7.3	-13.9	-15.5	5.6
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R_w	24.0	34.0	40.0	45.0	49.0	49.0	
	10.4	Area correction		dB	-21.8	-31.8	-37.8	-42.8	-46.8	-46.8	
	Predicted noise level through vent		dB		33.3	20.7	14.6	4.7	-1.9	-3.5	19.4
Ventilation	Greenwood HD Vent 8000HD			D_{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-30.5	-29.5	-27.0	-26.3	-28.0	-31.4	
	Predicted noise level through vent		dB		24.5	22.9	25.3	21.1	16.8	11.8	26.1
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					34.7	27.3	25.9	21.2	17.0	12.0	27.4
Target dB(A) Level										30	
Pass/Fail										Pass	

Plots 1 & 2: Bedroom 3 L_{AFmax}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 1 & 4 Bedroom 3										
Room Type:	Bedroom (Lmax)										
Volume m³	27.9										
Façade Area m²	6.2										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			9.1	9.1	9.1	9.1	9.1	9.1		
	10*log(S/A)			-1.7	-1.7	-1.7	-1.7	-1.7	-1.7		
Incident Noise Level, dB				50.7	55.1	61.9	56.8	52.4	59.3	64.1	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R _w	20.0	21.0	33.0	40.0	36.0	48.0	
	1.0	Area correction		dB	-27.9	-28.9	-40.9	-47.9	-43.9	-55.9	
	Predicted noise level in building from glazing				dB	27.1	30.5	25.3	13.2	12.8	7.7
Solid Façade	Area m²	Brick/block cavity wall		R _w	41.0	45.0	45.0	54.0	58.0	58.0	
	5.2	Area correction		dB	-41.8	-45.8	-45.8	-54.8	-58.8	-58.8	
	Predicted noise level through solid façade				dB	13.3	13.7	20.5	6.4	-2.0	4.9
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R _w	24.0	34.0	40.0	45.0	49.0	49.0	
	10.4	Area correction		dB	-21.8	-31.8	-37.8	-42.8	-46.8	-46.8	
	Predicted noise level through vent				dB	33.3	27.7	28.5	18.4	10.0	16.9
Ventilation	Greenwood HD Vent 8000HD			D _{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-30.5	-29.5	-27.0	-26.3	-28.0	-31.4	
	Predicted noise level through vent				dB	24.5	29.9	39.2	34.8	28.7	32.2
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					34.7	34.3	39.8	34.9	28.9	32.4	40.6
Target dB(A) Level										45	
Pass/Fail										Pass	

Plots 2 & 3: Living Room

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 2 & 3 Living Room										
Room Type:	Living Room										
Volume m³	68.8										
Façade Area m²	27.3										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			22.4	22.4	22.4	22.4	22.4	22.4		
	10*log(S/A)			0.9	0.9	0.9	0.9	0.9	0.9		
Incident Noise Level, dB				58.1	56.2	50.7	51.4	51.0	47.4	57.0	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R _w	20.0	21.0	33.0	40.0	36.0	48.0	
	2.7	Area correction		dB	-30.0	-31.0	-43.0	-50.0	-46.0	-58.0	
	Predicted noise level in building from glazing				dB	34.9	32.0	14.5	8.2	11.8	-3.8
Solid Façade	Area m²	Brick/block cavity wall		R _w	41.0	45.0	45.0	54.0	58.0	58.0	
	24.6	Area correction		dB	-41.5	-45.5	-45.5	-54.5	-58.5	-58.5	
	Predicted noise level through solid façade				dB	23.5	17.6	12.1	3.8	-0.6	-4.2
Ventilation	Greenwood HD Vent 8000HD			D _{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-37.0	-36.0	-33.5	-32.8	-34.5	-37.9	
	Predicted noise level through vent				dB	28.0	27.1	24.1	25.5	23.4	16.4
Combined Noise Level (Glazing+Solid Façade+Ventilation)					36.0	33.3	24.8	25.6	23.7	16.5	31.0
Target dB(A) Level										35	
Pass/Fail										Pass	

Plots 2 & 3: Bedroom 1 L_{Aeq}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 2 & 3 Bedroom 1										
Room Type:	Bedroom (night-time)										
Volume m³	38.9										
Façade Area m²	21.1										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			12.7	12.7	12.7	12.7	12.7	12.7		
	10*log(S/A)			2.2	2.2	2.2	2.2	2.2	2.2		
Incident Noise Level, dB				50.7	48.1	48.0	43.1	40.5	38.9	49.4	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R_w	20.0	21.0	33.0	40.0	36.0	48.0	
	2.1	Area correction		dB	-30.0	-31.0	-43.0	-50.0	-46.0	-58.0	
	Predicted noise level in building from glazing		dB		28.9	25.3	13.2	1.3	2.7	-10.9	19.0
Solid Façade	Area m²	Brick/block cavity wall		R_w	41.0	45.0	45.0	54.0	58.0	58.0	
	19.0	Area correction		dB	-41.5	-45.5	-45.5	-54.5	-58.5	-58.5	
	Predicted noise level through solid façade		dB		17.5	10.9	10.8	-3.1	-9.7	-11.3	9.8
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R_w	24.0	34.0	40.0	45.0	49.0	49.0	
	14.4	Area correction		dB	-25.7	-35.7	-41.7	-46.7	-50.7	-50.7	
	Predicted noise level through vent		dB		33.3	20.7	14.6	4.7	-1.9	-3.5	19.4
Ventilation	Greenwood HD Vent 8000HD			D_{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-35.8	-34.8	-32.3	-31.6	-33.3	-36.7	
	Predicted noise level through vent		dB		23.1	21.5	23.9	19.7	15.4	10.4	24.7
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					35.0	27.8	24.9	19.9	15.7	10.6	26.7
Target dB(A) Level										30	
Pass/Fail										Pass	

Plots 2 & 3: Bedroom 1 L_{AFmax}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 2 & 3 Bedroom 1										
Room Type:	Bedroom (Lmax)										
Volume m³	38.9										
Façade Area m²	21.1										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			12.7	12.7	12.7	12.7	12.7	12.7		
	10*log(S/A)			2.2	2.2	2.2	2.2	2.2	2.2		
Incident Noise Level, dB				50.7	55.1	61.9	56.8	52.4	59.3	64.1	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R_w	20.0	21.0	33.0	40.0	36.0	48.0	
	2.1	Area correction		dB	-30.0	-31.0	-43.0	-50.0	-46.0	-58.0	
	Predicted noise level in building from glazing		dB		28.9	32.3	27.1	15.0	14.6	9.5	27.6
Solid Façade	Area m²	Brick/block cavity wall		R_w	41.0	45.0	45.0	54.0	58.0	58.0	
	19.0	Area correction		dB	-41.5	-45.5	-45.5	-54.5	-58.5	-58.5	
	Predicted noise level through solid façade		dB		17.5	17.9	24.7	10.6	2.2	9.1	22.4
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R_w	24.0	34.0	40.0	45.0	49.0	49.0	
	14.4	Area correction		dB	-25.7	-35.7	-41.7	-46.7	-50.7	-50.7	
	Predicted noise level through vent		dB		33.3	27.7	28.5	18.4	10.0	16.9	27.9
Ventilation	Greenwood HD Vent 8000HD			D_{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-35.8	-34.8	-32.3	-31.6	-33.3	-36.7	
	Predicted noise level through vent		dB		23.1	28.5	37.8	33.4	27.3	30.8	38.7
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					35.0	34.8	38.7	33.6	27.6	31.0	39.4
Target dB(A) Level										45	
Pass/Fail										Pass	

Plots 2 & 3: Bedroom 2 L_{Aeq}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 2 & 3 Bedroom 2										
Room Type:	Bedroom (night-time)										
Volume m³	44.1										
Façade Area m²	22.1										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			14.4	14.4	14.4	14.4	14.4	14.4		
	10*log(S/A)			1.9	1.9	1.9	1.9	1.9	1.9		
Incident Noise Level, dB				50.7	48.1	48.0	43.1	40.5	38.9	49.4	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R_w	20.0	21.0	33.0	40.0	36.0	48.0	
	2.0	Area correction		dB	-30.4	-31.4	-43.4	-50.4	-46.4	-58.4	
	Predicted noise level in building from glazing		dB		28.1	24.5	12.4	0.5	1.9	-11.7	18.3
Solid Façade	Area m²	Brick/block cavity wall		R_w	41.0	45.0	45.0	54.0	58.0	58.0	
	20.1	Area correction		dB	-41.4	-45.4	-45.4	-54.4	-58.4	-58.4	
	Predicted noise level through solid façade		dB		17.2	10.6	10.5	-3.4	-10.0	-11.6	9.5
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R_w	24.0	34.0	40.0	45.0	49.0	49.0	
	16.3	Area correction		dB	-25.3	-35.3	-41.3	-46.3	-50.3	-50.3	
	Predicted noise level through vent		dB		33.3	20.7	14.6	4.7	-1.9	-3.5	19.4
Ventilation	Greenwood HD Vent 8000HD			D_{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-36.0	-35.0	-32.5	-31.8	-33.5	-36.9	
	Predicted noise level through vent		dB		22.5	20.9	23.3	19.1	14.8	9.8	24.1
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					34.8	27.3	24.4	19.4	15.1	10.1	26.2
Target dB(A) Level										30	
Pass/Fail										Pass	

Plots 2 & 3: Bedroom 2 L_{AFmax}

Façade Noise Break-In Calculation				 DeltaSimons Protecting people and planet							
Room Name:	Plot 2 & 3 Bedroom 2										
Room Type:	Bedroom (Lmax)										
Volume m³	44.1										
Façade Area m²	22.1										
				Frequency, Hz						dB(A)	
				125	250	500	1000	2000	4000		
Room Information	Reverberation Time, sec			0.5	0.5	0.5	0.5	0.5	0.5		
	Absorption, A			14.4	14.4	14.4	14.4	14.4	14.4		
	10*log(S/A)			1.9	1.9	1.9	1.9	1.9	1.9		
Incident Noise Level, dB				50.7	55.1	61.9	56.8	52.4	59.3	64.1	
Safety Factor, dB				3.0	3.0	3.0	3.0	3.0	3.0		
Façade Elements											
Glazing	Area m²	Glass Systems 8/(6-16)/6 Double Glazed Unit		R _w	20.0	21.0	33.0	40.0	36.0	48.0	
	2.0	Area correction		dB	-30.4	-31.4	-43.4	-50.4	-46.4	-58.4	
	Predicted noise level in building from glazing				dB	28.1	31.5	26.3	14.2	13.8	8.7
Solid Façade	Area m²	Brick/block cavity wall		R _w	41.0	45.0	45.0	54.0	58.0	58.0	
	20.1	Area correction		dB	-41.4	-45.4	-45.4	-54.4	-58.4	-58.4	
	Predicted noise level through solid façade				dB	17.2	17.6	24.4	10.3	1.9	8.8
Roof/Ceiling	Area m²	Tiled/slatted roof, 12mm p/bd ceiling, 100mm m/w		R _w	24.0	34.0	40.0	45.0	49.0	49.0	
	16.3	Area correction		dB	-25.3	-35.3	-41.3	-46.3	-50.3	-50.3	
	Predicted noise level through vent				dB	33.3	27.7	28.5	18.4	10.0	16.9
Ventilation	Greenwood HD Vent 8000HD			D _{ne}	32.6	31.6	29.1	28.4	30.1	33.5	
	Area correction			dB	-36.0	-35.0	-32.5	-31.8	-33.5	-36.9	
	Predicted noise level through vent				dB	22.5	27.9	37.2	32.8	26.7	30.2
Combined Noise Level (Glazing+Solid Façade+Roof/Ceiling+Ventilation)					34.8	34.3	38.3	33.1	27.0	30.5	38.9
Target dB(A) Level										45	
Pass/Fail										Pass	