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Project:	J 04686 Noise Impact Assessment: 10a & 10b Burwell Road, Stevenage
Consultants:	Sound Planning Ltd 25a Vicarage Hill Lower Bourne Farnham Surrey GU10 3QS
Client:	Clovercourt
Prepared by:	D. M. Thomas
Signed:	 D. M. Thomas MSc M.I.O.A Acoustic Consultant
Dated:	Friday 22nd April 2022

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1.0 BACKGROUND

1.1 The planning proposal at 10a & 10b Burwell Road, Stevenage concerns the proposed development of 18 new homes (flats) with associated parking.

See APPENDIX 2 – Site Location/Plans

1.2 The site address falls under the planning jurisdiction of Stevenage Borough Council.

1.3 Stevenage Borough Council have requested a noise impact assessment to evaluate the impact of existing noise on the proposed development and design a suitable sound insulation scheme.

1.4 Existing Noise Climate

The site is exposed to road traffic noise from Burwell Road to the North West and Chertsey Rise to the North East; other sources of noise include commercial noise from a convenience store and fish & chip shop (including mechanical plant) to the South and associated car parking area.

See APPENDIX 2 – Site Location/Plans

1.5 Sound Planning has been retained to carry out a noise impact assessment and design a suitable acoustic design scheme in accordance with appropriate standards.

1.5.1 Participating Acoustic Consultant

Dan Thomas is a Member of the Institute of Acoustics (M.I.O.A) having attained appropriate qualifications in acoustics and experience within the workplace.

1.5.2 Qualifications

Dan has been working within the noise and vibration industry for fourteen years and has attained the following qualifications within the field of acoustics:

- Institute of Acoustics (IOA) Diploma
- Post Graduate Diploma in Applied Acoustics and Noise Control (University of Surrey)

- Masters Degree in Applied Acoustics and Noise Control (University of Surrey)

2.0 ASSESSMENT CRITERIA

The noise assessment and acoustic report should be carried out in accordance with relevant standards and guidelines in conjunction with the Local Authority's validation Unitary Development Plan (UDP).

2.1 The National Planning Policy Framework (July 2021)

2.1.1 The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

2.1.2 Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. The National Planning Policy Framework must be taken into account in preparing the development plan, and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

2.1.3 The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

2.1.4 Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

a) **An economic objective** - to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) **A social objective** to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities health, social and cultural well-being; and

c) **An environmental objective** to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

2.1.5 Relevant Paragraphs in NPPF (Noise)

Paragraph 174

Planning policies and decisions should contribute to and enhance the natural and local environment by:

a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan)

b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;

c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;

d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Paragraph 185

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

Paragraph 187

Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

2.1.6 Sound Planning will utilise relevant planning policy such as BS 4142: 2014; BS 8233: 2014, World Health Organisation's Guidelines for Community Noise etc in order to meet the objectives set out within The National Planning Policy Framework July 2021.

2.2 British Standard 7445-1: 2003[1]

2.2.1 The methods and procedures described in BS 7445 are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site.

2.2.2 The aim of the BS 7445 series is to provide authorities with material for the description of noise in community environments. Based on the principles described in this standard, acceptable limits of noise can be specified and compliance with these limits can be controlled.

2.2.3 BS 7445 does not specify limits for environmental noise.

2.3 British Standard 8233: 2014[2]

2.3.1 BS 8233: 2014 is the *Guidance on sound insulation and noise reduction for buildings – Code of practice*.

2.3.2 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 16hour}$

2.3.3 Note 7: *Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.*

[1] Description and measurement of environmental noise. Part 1 – Guide to quantities and procedures.
[2] Supersedes BS 8233: 1999.

2.3.4 Note 4: *Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guidance value may be set in terms of SEL of $L_{Amax,P}$ depending on the character and number of events per night. Sporadic noise events could require separate values.*

WHO Guidelines suggest a 45 dB L_{AFmax} criterion for preventing sleep disturbance in bedrooms at night time.

2.3.5 External Amenity Areas

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

2.4 ProPG: Planning and Noise - May 2017

2.4.1 Primary Goals

The primary goal of the ProPG is to assist in the delivery of sustainable development by promoting good health and well-being through the effective management of noise. It seeks to do that through encouraging a good design process in and around proposed new residential development having regard to national policy on planning and noise. The ProPG recommends an approach for new residential development that would be exposed predominantly to noise from existing transport sources; the approach is also considered suitable where some industrial or commercial noise contributes (but is not dominant) to the acoustic environment.

2.4.2 Two Stage Approach

- Stage 1 An initial noise risk assessment of the proposed site
- Stage 2 A systematic consideration of four key elements

2.4.3 Stage 2 - Key Elements

- Element 1 Demonstrating a *Good Acoustic Design Process*
- Element 2 Observing internal *Noise Level Guidelines*
- Element 3 Undertake an *External Amenity Area Noise Assessment*
- Element 4 Consideration of *Other Relevant Issues*

2.4.4 Internal Noise Level Guidelines

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 16hour}$ 45 dB L_{AFmax}[3]

2.4.5 External Amenity Area Noise

The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 - 55 dB $L_{Aeq, 16hrs}$.

2.4.6 Acoustic Design Statement

The approach is underpinned by the preparation of an "Acoustic Design Statement".

See APPENDIX 6 for further details.

[3] 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 45 dB L_{AFmax} more than 10 times a night.

2.4.7 Report Recommendations

The approach should lead to one of four possible recommendations from the noise practitioner to the decision maker:

A *Planning consent may be granted without any need for noise conditions*

B *Planning consent may be granted subject to the inclusion of suitable noise conditions*

C *Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid")*

D *Planning consent should be refused on noise grounds in order to prevent significant adverse effects ("prevent")*

2.5 World Health Organisation: Guidelines for Community Noise[4]

2.5.1 The W.H.O document covers a wide array of environmental noise issues and appropriate assessment criteria in relation to acceptable noise levels in various situations.

2.5.2 The Guidelines look at appropriate assessment methodology and statistical parameters which are most relevant when looking at particular noise sources; whether they cause annoyance and to what degree.

2.53 *The capacity of a noise to induce annoyance depends upon its physical characteristics, including the sound pressure level, spectral characteristics and variations of these properties with time. Noise with low-frequency components require lower guideline values. For intermittent noise, it is emphasized that it is necessary to take into account both the maximum sound pressure level and the number of noise events.*

[4] World Health Organisation Recommended Levels for Community Noise 2000.

2.5.4 W.H.O – Amenity Criteria

Specific Environment	Critical Health Effects	L_{Aeq} (dB)	Time Base (hours)	$L_{AF\ max}$ (dB)
Outdoor Living Area	Serious annoyance, daytime evening	55	16	
	Moderate annoyance, daytime 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

3.0 METHODOLOGY

3.1 Ambient Noise Measurements: Microphone Position 1 – Rear of 10a Burwell Road

3.1.1 A Class 1 sound level meter with real time one third octave band functionality was installed in a secure position representative of the proposed new dwellings to the rear of 10a Burwell Road and the designated 'open space'

The microphone position is shown in APPENDIX 2 – Site Locations/Plans and APPENDIX 3 – Site Photographs.

3.1.2 The microphone was protected with a wind/weather shield[5] and attached to an environmental tripod 1.5m above ground level with direct line of sight to Chertsey Rise to the North East (elevated rear garden). The position should be considered free field.

3.1.3 The sound level meter logged sound levels for the duration of the extended monitoring period.

[5] See Section 4.0 – Instrumentation.

3.1.4 The monitoring period commenced at 10:45 hours Tuesday 15th February with continuous measurements (15 minute periods) until 15:45 hours Wednesday 16th February, 2022.

3.1.5 Sound Planning conducted environmental noise measurements in accordance with BS 7445: 2003[6].

3.2 Ambient Noise Measurements: Microphone Position 2 – 10b Burwell Road

3.2.1 A Class 1 sound level meter with real time one third octave band functionality was installed in a secure position representative of the proposed new dwellings closest to the junction between Burwell Road and Chertsey Rise to the North of the site.

The microphone position is shown in APPENDIX 2 – Site Locations/Plans and APPENDIX 3 – Site Photographs.

3.2.2 The microphone was protected with a wind/weather shield[7] and attached to an environmental tripod 1.2m above 1st floor flat roof level with direct line of sight to the junction between Burwell Road and Chertsey Rise.

3.2.3 The sound level meter logged sound levels for the duration of the extended monitoring period.

3.2.4 The monitoring period commenced at 11:15 hours Tuesday 15th February with continuous measurements (15 minute periods) until 16:15 hours Wednesday 16th February, 2022.

3.2.5 Sound Planning conducted environmental noise measurements in accordance with BS 7445: 2003.

3.3 Internal noise level calculations are based on calculation methods laid out in BS 8233.

3.4 The highest maximum level L_{max} during the night time period was selected to evaluate potential sleep disturbance.

[6] British Standard BS 7445-1: 2003. *Description and measurement of environmental noise.* ISBN 0 580 43032 4
[7] See Section 4.0 – Instrumentation.

3.5 Internal noise level calculations utilise sound reduction data from OEM[8] laboratory test data sheets i.e. glazing, ventilation manufacturers; and typical sound reduction data from ADE 2003[9] for composite wall and roof/ceiling systems.

4.0 INSTRUMENTATION

4.1 Sound Monitoring Equipment

Equipment	Make	Model	Class	Serial Number	UKAS Calibration
SLM	Norsonic	Nor 140	1	1405819	U34833 (27/5/20)
SLM	Casella	CEL 490	1	128950	U38188 (18/6/21)
Field Calibrator	Casella	CEL 110/1	1	077948	U38181 (16/6/21)
Environmental Tripods					
Wind/Weather Shield					
Digital Camera	Samsung				
Tape Measure					
Laser Measure	Leica				

4.2 Sound Level Meter Calibration

The microphones were field calibrated before and after measurement periods – No significant deviation was detected.

UKAS Calibration Certificates are available on request.

[8] Original Equipment Manufacturer.
[9] Annex C – Draft version of ADE 2003 – Cited Watson et al. *The Little Red Book of Acoustics*. BTA 2007.

5.0 RESULTS

5.1 Existing Ambient Noise Levels

5.1.1 Microphone Position 1 – Rear of 10a Burwell Road (South East Elevation)

Day of Week	Average Sound Levels		Maximum Levels[10]
	Day	Night	Night
	07:00 - 23:00 hrs	23:00 - 07:00 hrs	23:00 - 07:00 hrs
	dB $L_{Aeq, T}$	dB $L_{Aeq, T}$	dB L_{Amax}
Tuesday	51	48	73 / 71 / 71
Wednesday	52	/	/

5.1.2 Microphone Position 2 – Front of 10b Burwell Road (North East Elevation)

Day of Week	Average Sound Levels		Maximum Levels
	Day	Night	Night
	07:00 - 23:00 hrs	23:00 - 07:00 hrs	23:00 - 07:00 hrs
	dB $L_{Aeq, T}$	dB $L_{Aeq, T}$	dB L_{Amax}
Tuesday	55	46	70 / 68 / 68
Wednesday	54	/	/

[10] Maximum 3 levels during the night time period for that date.

5.2 Noisiest Hours (L_{Aeq})

5.2.1 Microphone Position 1 – Rear of 10a Burwell Road (South East Elevation)

Day of Week	Sound Levels	
	Day	Night
	dB $L_{Aeq, T}$	dB $L_{Aeq, T}$
Tuesday	54	55
Wednesday	53	/

5.2.2 Microphone Position 2 – Front of 10b Burwell Road (North East Elevation)

Day of Week	Sound Levels	
	Day	Night
	dB $L_{Aeq, T}$	dB $L_{Aeq, T}$
Tuesday	58	51
Wednesday	56	/

5.3 Meteorological Conditions[11]

Meteorological conditions were mixed (sporadic light rain with moderate wind speeds); conditions should be deemed acceptable in accordance with BS 7445: 2003.

See APPENDIX 8 – Meteorological Conditions

[11] Source: www.wunderground.com

6.0 CRITERIA ASSESSMENT

6.1 ProPG Evaluation

6.1.1 Microphone Position 1 – Rear of 10a Burwell Road (South East Elevation)

Daytime:

Sound level: 52 dB $L_{Aeq, 16hrs}$

Comment:

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.

Night Time:

Sound Level: 48 dB $L_{Aeq, 8hrs}$

Comment:

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.

6.1.2 Microphone Position 2 – Front of 10b Burwell Road (North East Elevation)

Daytime:

Sound level: 55 dB $L_{Aeq, 16hrs}$

Comment:

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.

Night Time:

Sound Level: 46 dB $L_{Aeq, 8hrs}$

Comment:

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.

6.2 BS 8233: 2014 Evaluation (Noisiest Hours) – Sound Insulation Requirements[12]

6.2.1 Microphone Position 1 – Rear of 10a Burwell Road (South East Elevation)

Day of Week	Sound Level (noisiest hours)		Sound Insulation Requirement (BS 8233: 2014)	
	Day	Night	Day (35)	Night (30)
	dB $L_{Aeq, T}$	dB $L_{Aeq, T}$	dB R_w	dB R_w
Tuesday	54	55	19	25
Wednesday	53	/	18	/

6.2.2 Microphone Position 2 – Front of 10b Burwell Road (North East Elevation)

Day of Week	Sound Level (noisiest hours)		Sound Insulation Requirement (BS 8233: 2014)	
	Day	Night	Day (35)	Night (30)
	dB $L_{Aeq, T}$	dB $L_{Aeq, T}$	dB R_w	dB R_w
Tuesday	58	51	23	21
Wednesday	56	/	21	/

[12] The sound insulation requirement is based upon the noisiest hours measured during the given time period.

6.3 BS 8233: 2014 Evaluation - Maximum Internal Noise Levels (Night Time)

6.3.1 Microphone Position 1 – Rear of 10a Burwell Road (South East Elevation)

Day of Week	Maximum Level[13]	Maximum Internal Level Permitted	Sound Insulation Requirement (bedrooms)
	dB L_{Amax}	dB L_{Amax}	dB R_w
Tuesday	71	45	26
Wednesday	/	45	/

6.3.2 Microphone Position 2 – Front of 10b Burwell Road (North East Elevation)

Day of Week	Maximum Level	Maximum Internal Level Permitted	Sound Insulation Requirement (bedrooms)
	dB L_{Amax}	dB L_{Amax}	dB R_w
Tuesday	68	45	23
Wednesday	/	45	/

6.4 BS 8233: 2014 / World health Organisation Evaluation - External Noise Levels (Day)

6.4.1 BS 8233: 2014

"*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,.}$"*

[13] Sound Planning has used the 3rd highest maximum level recorded; ProPG states that *'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 45 dB L_{AFmax} more than 10 times a night.'*

6.4.2 External Amenity Area

The proposed site plan shows an 'open space' to the rear of 10a Burwell Road; Sound Planning has considered this area to be an amenity area.

The 'open space' area would experience daytime noise levels between 51 - 52 dB $L_{Aeq, 16hrs}$.

See paragraph 6.1.1

Sound levels within the 'open space' area should be considered acceptable in accordance with BS 8233: 2014.

See paragraph 6.4.1

7.0 ACOUSTIC DESIGN SCHEME (ADS)

7.1 The acoustic design scheme should include a suitable sound insulation scheme (wall, glazing, ventilation, roof) to meet the internal design standards laid out in British Standard 8233: 2014.

7.2 In consideration of noise sources affecting the proposed development site sound insulation products (specifically glazing products) should refer to OEM's adaption spectrums (C_{tr}) which allows for reduced acoustic performance for sources such as urban road traffic noise.

See APPENDIX 1 – Glossary of Acoustic Terms & APPENDIX 5 – Noise Mitigation Products

7.3 Example of Suitable Sound Insulation Products to Meet Design Standards[14]

7.3.1 Living Rooms (L_{Aeq} daytime) [Both Microphone Positions – Worst Case]

Product	Noisiest Hour dB L_{Aeq}	BS 8233 Internal Target Level dB L_{Aeq}	Sound Insulation Requirement dB $R_w + C_{tr}$	Example Suitable Product
Glazing	58	35	58 - 35 = 23	6mm / (6-16mm) / 4mm[15]
Ventilation	58	35	58 - 35 = 23	AWV39

7.3.2 Bedrooms (L_{Aeq} night time) [Both Microphone Positions – Worst Case]

Product	Noisiest Hour dB L_{Aeq}	BS 8233 Internal Target Level dB L_{Aeq}	Sound Insulation Requirement dB $R_w + C_{tr}$	Example Suitable Product
Glazing	55	30	55 - 30 = 25	6mm / (6-16mm) / 4mm
Ventilation	55	30	55 - 30 = 25	AWV39

7.3.3 Bedrooms (night time) – Maximum Level [Both Microphone Positions]

Product	Maximum Level dB L_{Aeq}	BS 8233 Internal Target Level dB L_{AMax}	Sound Insulation Requirement dB R_w [16]	Example Suitable Product
Glazing	71	45	71 - 45 = 26	6mm / (6-16mm) / 4mm
Ventilation	71	45	71 - 45 = 26	AWV39

[14] It has been assumed that the external wall is brick/brick or brick/block cavity wall.
[15] 6mm / (6-16mm) / 4mm achieves 28 dB $R_w + C_{tr}$.
[16] Isolated maximum noise level events need not incur the C_{tr} correction requirement.

7.4 Suppliers

Product	Supplier	Contact Telephone Number
Glazing	Pilkington (NSG Group)	01744 692000
Ventilation	Greenwood	01276 408404

8.0 CONCLUSIONS

8.1 A detailed noise assessment, providing full details of existing daytime and night time noise levels at the site, proposed attenuation methods and predicted internal noise levels has been carried out by Sound Planning Ltd.

8.2 Noise measurements were carried out in accordance with BS 7445: 2003.

See section 3.0 – METHODOLOGY

8.3 Noise Risk Assessment (ProPG) - Proposed New Dwellings

8.3.1 Daytime:

ProPG Comment:

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.

8.3.2 Night Time:

ProPG Comment:

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.

8.4 The noisiest hours and maximum night time noise levels have been detailed and used in the design of a suitable sound insulation scheme.

See section 4.0 - RESULTS

8.5 Sound Planning has proposed an internal sound insulation scheme in order to meet the requirements of BS 8233: 2014.

See sections 6.0 – CRITERIA ASSESSMENT & 7.0 – ACOUSTIC DESIGN SCHEME (ADS)

8.6 External Amenity Areas

8.6.1 The proposed site plan shows an 'open space' to the rear of 10a Burwell Road; Sound Planning has considered this area to be an amenity area.

8.6.2 The 'open space' area would experience daytime noise levels between 51 - 52 dB $L_{Aeq, 16hrs}$.

8.6.3 Sound levels within the 'open space' area should be considered acceptable in accordance with BS 8233: 2014.

See paragraph 6.4.2

8.7 Acoustic Design Scheme

8.7.1 Sound Planning has developed a suitable acoustic design scheme (ADS) confirming how the adverse impact of noise on the proposed development will be mitigated and minimised.

8.7.2 The ADS includes the following areas:

- Façade Sound Insulation Design
- Acoustic Ventilation
- Consideration of external amenity areas
- Consideration of road traffic noise
- Suppliers/Contractors

See section 7.0 – ACOUSTIC DESIGN SCHEME

8.7.3 Glazing & Ventilation

The specified glazing performance has the rating terms $R_w + C_{tr}$ which are an adaption for the overall weighted sound reduction taking into account typical sound spectrums from the following noise types[17]:

- Urban traffic noise
- Railway noise at low speeds
- Jet aircraft at large distances
- Disco music
- Factories emitting mainly low and medium frequency noise

8.7.4 Report Recommendation:

From a noise perspective, planning conditions pertaining to noise can be discharged subject to the implementation of the ADS within this report.

[17] The noise control product performance $R_w + C_{tr}$ adaption spectrum takes into consideration noise emitted by urban traffic, rail traffic, factories and industrial sources of noise and corrects accordingly.

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APPENDIX 1

Glossary of Acoustic Terms

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} pascals) and the threshold of pain is around 120 dB. The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

Noise Rating

The Noise Rating (NR) system is a set of octave band sound pressure level curves used for specifying limiting values for building services noise. The Noise Criteria (NC) and Preferred Noise Criteria (PNC) systems are similar.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

$L_{Aeq, T}$ *The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq, T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.*

L_{AE} *Where the overall noise level over a given period is made up of individual noise events, the $L_{Aeq, T}$ can be predicted by measuring the noise of the individual noise events using the sound exposure level, L_{AE} (or SEL or L_{AX}). It is defined as the level that, if maintained constant for a period of one second, would deliver the same A-weighted sound energy as the actual noise event.*

L_{A10} *The level exceeded for 10% of the time is often used to describe road traffic noise.*

L_{A90} *The level exceeded for 90% of the time is normally used to describe background noise.*

Sound Transmission Descriptors

D_{nT} Standardised level difference

$D_{nT, w}$ Weighted standardised level difference

L_1 The average sound pressure level in the source room

L_2 The average sound pressure level in the receiving room

T Reverberation time (receiving room)

T_0 Reference reverberation time = 0.5s

C_{tr} Adaption spectrum which takes account for low to medium speed road/rail/air traffic; disco music; and factory noise (medium to low frequency noise).

C Adaptation spectrum which takes account of domestic activities including speech, music, radio and television.

R_{TRA} Traffic Noise Reduction

Frequency Analysis

Octave Band	*A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000 Hz…*
One Third Octave	*The logarithmic frequency interval between a lower frequency f_2, when f_2/f_1 equals $2^{1/3}$ apart. Frequencies include: 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000Hz.*

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law.

In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB. Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening and Diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological Effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradient are variable and difficult to predict.

soundplanning

APPENDIX 2

Site Location/Plans

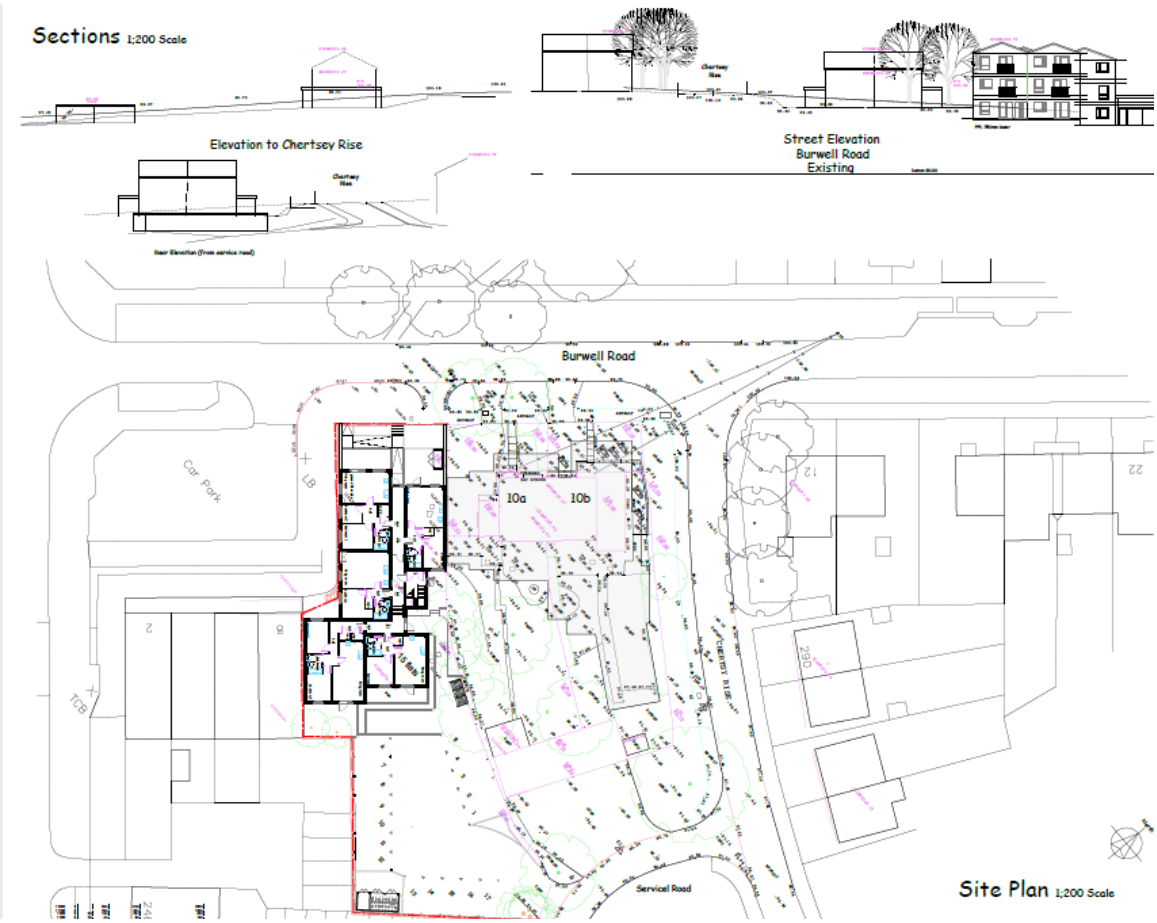
Google Earth Site View

Site & Surrounding Area

soundplanning

Site Location/Plans

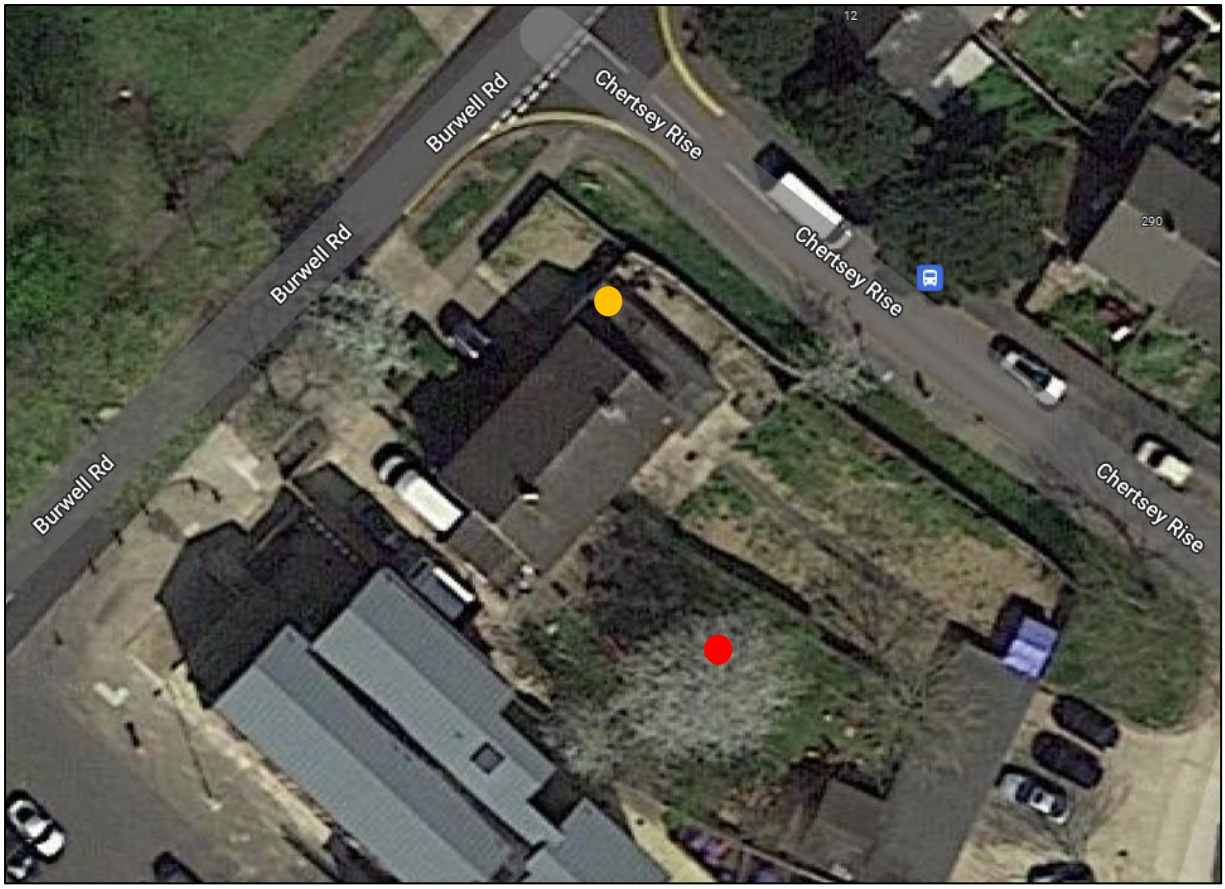
Location Plan/Elevations



Site Location/Plans

Google Earth Site View

Microphone Positions



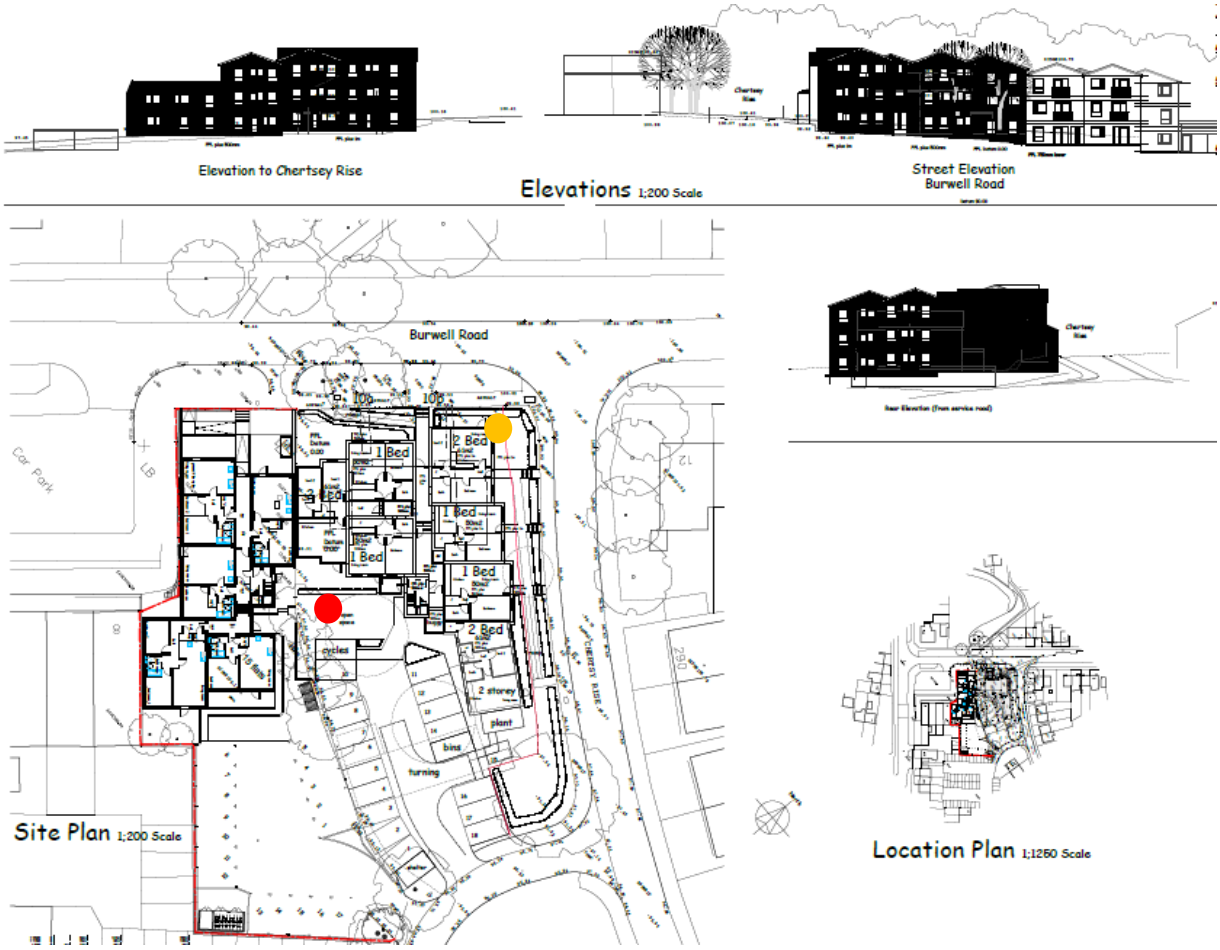
Key:

- *Microphone Position 1 – Rear of 10a Burwell Road*
- *Microphone Position 2 – Burwell Road / Chertsey Rise (front/side elevation) 10b Burwell Road*

Site Location/Plans

Proposed Site Plan/Elevations

& Microphone Positions



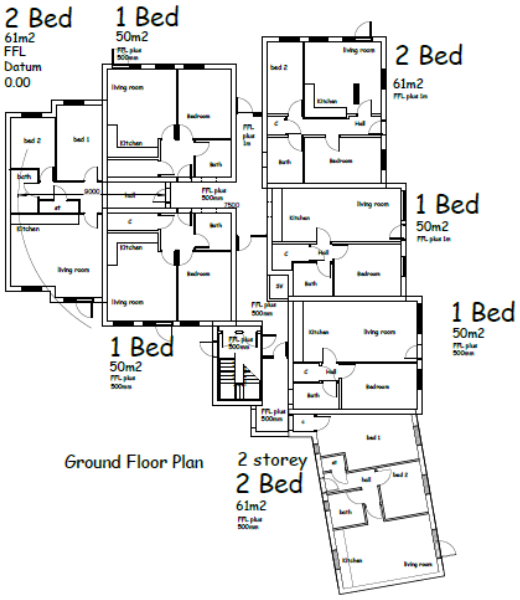
Key:

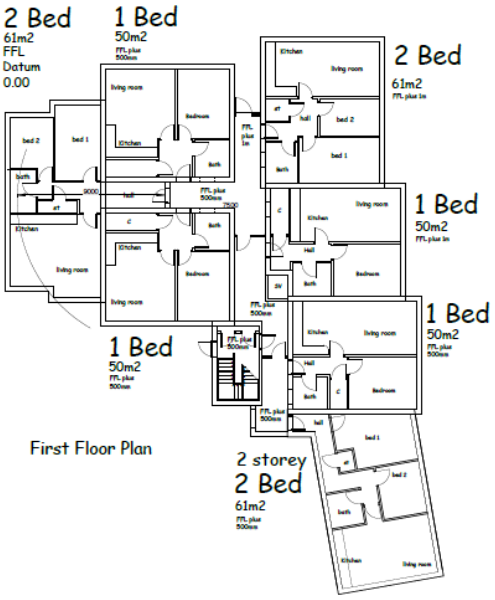
- *Microphone Position 1 – Rear of 10a Burwell Road*
- *Microphone Position 2 – Burwell Road / Chertsey Rise (front/side elevation) 10b Burwell Road*

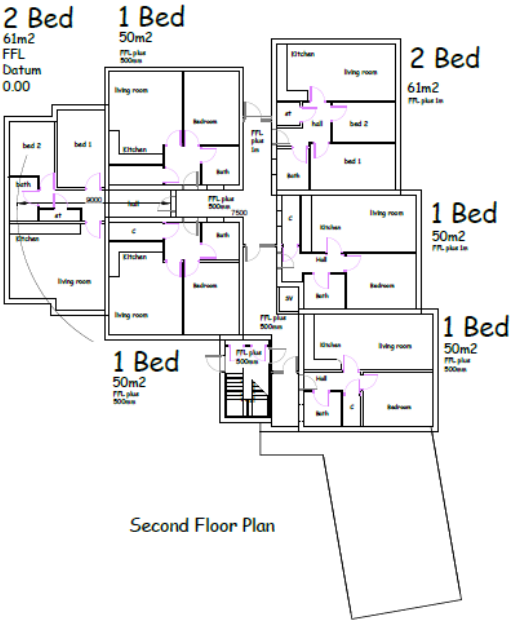
soundplanning

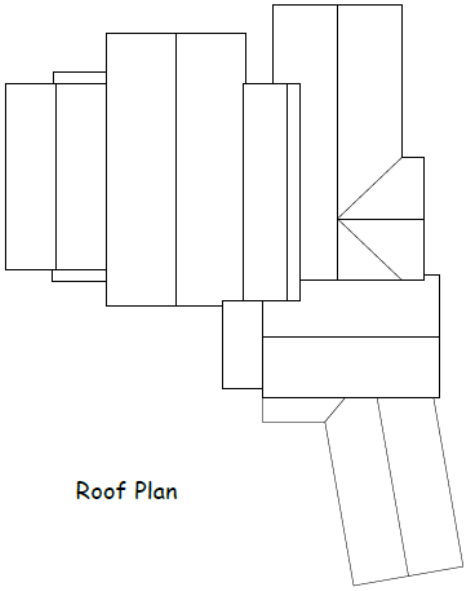
Site Location/Plans

Proposed Layout









soundplanning

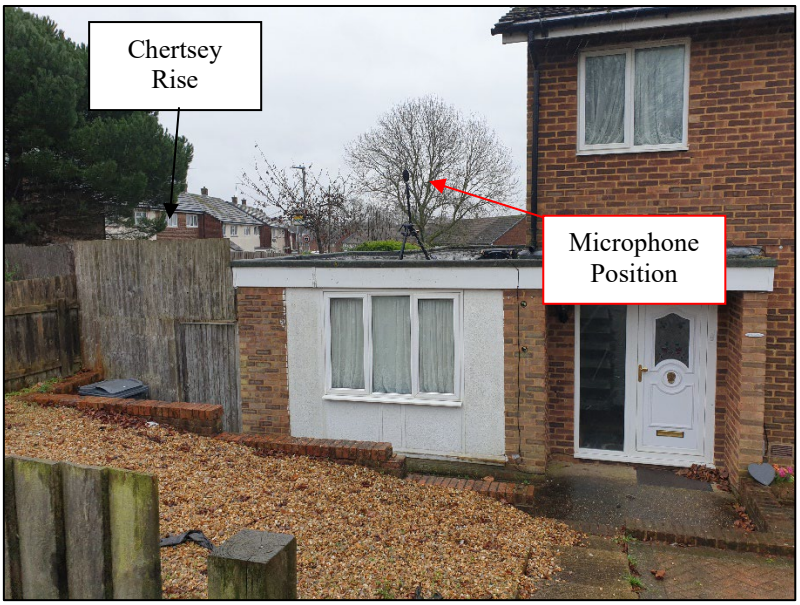
APPENDIX 3

Site Photographs

Microphone Position 1 – Rear of 10a Burwell Road

Microphone Position 2 – Front (NE) Elevation of 10b Burwell Road

Site Photographs



Microphone Position 2 – Front (NE) Elevation of 10b Burwell Road

soundplanning

APPENDIX 4

Ambient Noise Levels

Microphone 1 (10a Burwell - Rear)

Table

Period	Date	Time	L_{Fmax}	L_{Fmin}	L_{eq}	L_{F50}	L_{F90}	$L_{eq, 1hr}$
			dB, (A)	dB, (A)	dB, (A)	dB, (A)	dB, (A)	dB, (A)
1	2/15/2022	10:45:00	77.6	43.3	52.1	49	46	
2	2/15/2022	11:00:00	65.4	44.2	50.5	49.5	46	52.1
3	2/15/2022	11:15:00	74.2	45.9	51.6	50	48	
4	2/15/2022	11:30:00	71.8	46.8	53.3	51.5	49	
5	2/15/2022	11:45:00	72.4	46.3	52.5	51	49	
6	2/15/2022	12:00:00	73.1	46.6	54.3	52	49	54.4
7	2/15/2022	12:15:00	71.5	46.5	54.1	51.5	48.5	
8	2/15/2022	12:30:00	77.1	47.2	55.3	52	49.5	
9	2/15/2022	12:45:00	76.1	46.3	53.9	51.5	48.5	
10	2/15/2022	13:00:00	73.6	45.2	51.9	50	47	52.7
11	2/15/2022	13:15:00	77.9	44.3	55.5	52.5	47	
12	2/15/2022	13:30:00	76.2	43.1	51.3	49	45.5	
13	2/15/2022	13:45:00	73.8	43	50.1	48	45.5	
14	2/15/2022	14:00:00	67.6	42.9	49.8	48	45	50.1
15	2/15/2022	14:15:00	73.1	43.9	50.4	48.5	46	
16	2/15/2022	14:30:00	70.5	42.6	51.2	48.5	45.5	
17	2/15/2022	14:45:00	68.5	41.5	48.6	46.5	43.5	
18	2/15/2022	15:00:00	67.5	42.2	50.4	47.5	44.5	49.4
19	2/15/2022	15:15:00	66	41.6	49.4	46	43.5	
20	2/15/2022	15:30:00	60.9	41.6	47	45.5	43.5	
21	2/15/2022	15:45:00	64.4	41.7	50.2	47.5	44.5	
22	2/15/2022	16:00:00	63.1	41.6	48.7	46.5	44	49.6
23	2/15/2022	16:15:00	62.6	41.6	49.6	46.5	44	
24	2/15/2022	16:30:00	71	42.3	50	47.5	44.5	
25	2/15/2022	16:45:00	62.6	41	49.9	46.5	43.5	
26	2/15/2022	17:00:00	61.9	42.1	49.1	47	45	50.0
27	2/15/2022	17:15:00	64.9	42.9	50.2	48	45	
28	2/15/2022	17:30:00	64.2	42.4	51.4	48	44.5	
29	2/15/2022	17:45:00	60.8	42.4	48.9	46.5	44.5	
30	2/15/2022	18:00:00	61.7	41.6	49.5	46.5	44	49.4
31	2/15/2022	18:15:00	61.7	42.6	49.5	46.5	44.5	

32	2/15/2022	18:30:00	68.3	42.3	51	47	44	
33	2/15/2022	18:45:00	71.7	41.2	46.8	45.5	43.5	
34	2/15/2022	19:00:00	58.7	40.7	47.4	45.5	43	48.6
35	2/15/2022	19:15:00	64.6	40.9	50.8	46	43	
36	2/15/2022	19:30:00	63.8	39.3	49.1	44.5	41.5	
37	2/15/2022	19:45:00	59.1	38.3	45.5	42.5	40.5	
38	2/15/2022	20:00:00	65.1	38.6	48.1	43.5	40.5	47.3
39	2/15/2022	20:15:00	62.3	38.2	47.6	43.5	40	
40	2/15/2022	20:30:00	63.8	37.7	47.6	41.5	39.5	
41	2/15/2022	20:45:00	64.2	37.1	45.7	41	39	
42	2/15/2022	21:00:00	61.4	37.4	46.9	41.5	39	47.5
43	2/15/2022	21:15:00	64.9	35.9	46.4	41	38	
44	2/15/2022	21:30:00	64.1	35.3	46.3	40.5	37.5	
45	2/15/2022	21:45:00	64.3	35.2	49.6	43	38	
46	2/15/2022	22:00:00	59.8	36.2	44.3	40.5	37.5	47.2
47	2/15/2022	22:15:00	63.8	36.5	46.8	41.5	38.5	
48	2/15/2022	22:30:00	66.1	36.6	49.1	42.5	38.5	
49	2/15/2022	22:45:00	63.3	36.7	47.2	41	38.5	
				Day 1	50.5	dB $L_{Aeq,T}$		
50	2/15/2022	23:00:00	60.9	35.2	44.5	40	37.5	43.2
51	2/15/2022	23:15:00	61.5	32.5	43.7	37.5	35	
52	2/15/2022	23:30:00	51.5	31.2	38.6	35.5	33.5	
53	2/15/2022	23:45:00	62.4	32.4	43.8	36.5	34.5	
54	2/15/2022	0:00:00	58	32.8	39.7	37	35	41.6
55	2/16/2022	0:15:00	58.2	32.4	39.7	37.5	34.5	
56	2/16/2022	0:30:00	59.1	32.9	41.6	38	35.5	
57	2/16/2022	0:45:00	69.4	31.9	43.9	37.5	34.5	
58	2/16/2022	1:00:00	62.1	32.4	45.9	41.5	35.5	44.2
59	2/16/2022	1:15:00	68.3	33.2	46.4	39.5	36	
60	2/16/2022	1:30:00	64	30.8	39.8	37	33.5	
61	2/16/2022	1:45:00	59.3	30.5	40.9	35.5	33	
62	2/16/2022	2:00:00	60.2	29.7	40	34.5	31.5	38.5
63	2/16/2022	2:15:00	64.8	29	38.9	33	31	
64	2/16/2022	2:30:00	61.3	29.6	38	33.5	31.5	
65	2/16/2022	2:45:00	59.9	29	36	33.5	31.5	
66	2/16/2022	3:00:00	60.2	29.9	38.5	34.5	31.5	40.5
67	2/16/2022	3:15:00	67.9	29.7	43.4	34.5	31.5	
68	2/16/2022	3:30:00	63	30.6	40.1	34.5	32	
69	2/16/2022	3:45:00	57.9	29.7	37.3	34	31.5	
70	2/16/2022	4:00:00	62.5	29.5	37.9	34.5	31.5	40.7

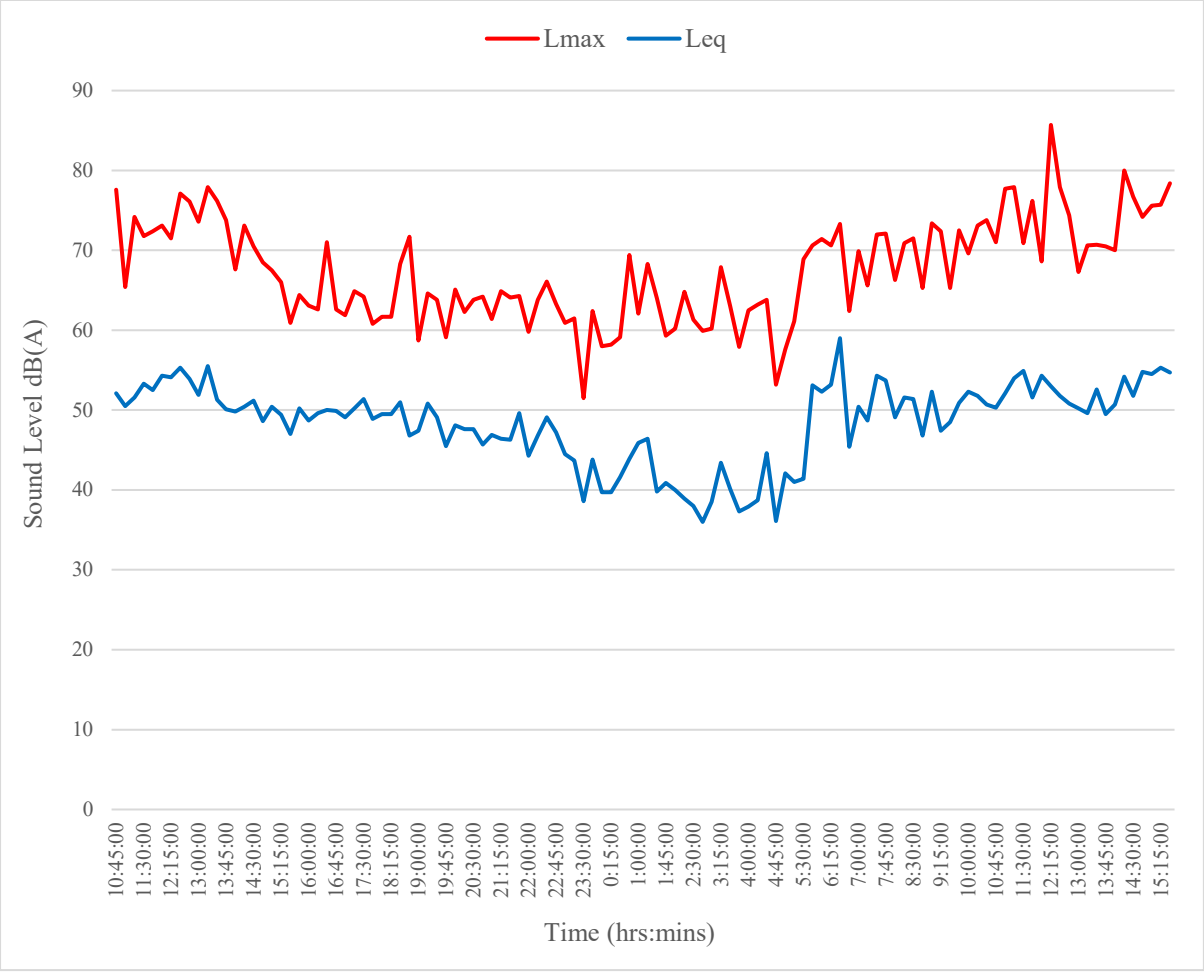
71	2/16/2022	4:15:00	63.2	29.9	38.7	35	32.5	
72	2/16/2022	4:30:00	63.8	29.2	44.6	35.5	32	
73	2/16/2022	4:45:00	53.2	29.9	36.1	34	31.5	
74	2/16/2022	5:00:00	57.6	30.8	42.1	38	34	
75	2/16/2022	5:15:00	61.1	32.4	41	38	35.5	47.9
76	2/16/2022	5:30:00	68.9	32.6	41.4	37.5	35	
77	2/16/2022	5:45:00	70.6	34.9	53.1	41.5	37	
78	2/16/2022	6:00:00	71.4	34.9	52.3	41.5	38	
79	2/16/2022	6:15:00	70.6	36.8	53.2	43	39.5	54.8
80	2/16/2022	6:30:00	73.3	37.5	59	47.5	40	
81	2/16/2022	6:45:00	62.4	37.2	45.4	43.5	40	
				Night 1	47.5	dB $L_{Aeq,T}$		
82	2/16/2022	7:00:00	69.9	38.5	50.4	46	41.5	
83	2/16/2022	7:15:00	65.6	39.8	48.7	45.5	42.5	52.4
84	2/16/2022	7:30:00	72	40.1	54.3	48.5	43	
85	2/16/2022	7:45:00	72.1	40.2	53.7	48	44	
86	2/16/2022	8:00:00	66.3	40.2	49.1	46	43	
87	2/16/2022	8:15:00	70.9	40.9	51.6	47	43.5	50.1
88	2/16/2022	8:30:00	71.5	40.1	51.4	45.5	42.5	
89	2/16/2022	8:45:00	65.3	40.1	46.8	44.5	42	
90	2/16/2022	9:00:00	73.4	38.7	52.3	45	42	
91	2/16/2022	9:15:00	72.4	39.5	47.4	44.5	42	50.2
92	2/16/2022	9:30:00	65.3	40.5	48.5	45.5	43	
93	2/16/2022	9:45:00	72.5	40.5	50.9	46	43.5	
94	2/16/2022	10:00:00	69.6	41.5	52.3	48	44	
95	2/16/2022	10:15:00	73.1	40	51.8	47	44	51.3
96	2/16/2022	10:30:00	73.8	40	50.7	46.5	43	
97	2/16/2022	10:45:00	71	39.6	50.3	46.5	43	
98	2/16/2022	11:00:00	77.7	41.4	52.1	47	44	
99	2/16/2022	11:15:00	77.9	41.7	54	48.5	44.5	53.4
100	2/16/2022	11:30:00	70.9	41.5	54.9	51.5	44.5	
101	2/16/2022	11:45:00	76.2	41.4	51.6	48	44.5	
102	2/16/2022	12:00:00	68.6	41.4	54.3	49	45	
103	2/16/2022	12:15:00	85.7	39.5	53	45	42	52.7
104	2/16/2022	12:30:00	77.9	40.5	51.8	46.5	42.5	
105	2/16/2022	12:45:00	74.4	40.7	50.8	47	43.5	
106	2/16/2022	13:00:00	67.3	40.7	50.2	47.5	44	
107	2/16/2022	13:15:00	70.6	40.9	49.6	46	43	50.7
108	2/16/2022	13:30:00	70.7	41.5	52.6	48	43.5	
109	2/16/2022	13:45:00	70.5	40.1	49.5	45.5	43	

110	2/16/2022	14:00:00	70	41.1	50.7	46.5	44	53.2
111	2/16/2022	14:15:00	80	42.6	54.2	50.5	46	
112	2/16/2022	14:30:00	76.7	42.3	51.8	49	45.5	
113	2/16/2022	14:45:00	74.2	42.7	54.8	51	46	
114	2/16/2022	15:00:00	75.6	43.6	54.5	50.5	46.5	
115	2/16/2022	15:15:00	75.7	42	55.3	50.5	46	
116	2/16/2022	15:30:00	78.4	43.6	54.7	50.5	47	
				Day 2	52.3	dB $L_{Aeq,T}$		

Ambient Noise Levels

Microphone 1 (10a Burwell - Rear)

Graph



Ambient Noise Levels

Microphone Position 2 – 10b Burwell Road (Front)

Table

Date	Time	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{AF50}	L_{AF90}	$L_{eq, 1hr}$
(dd/m/yy)	(hrs:mins)	(dB)	(dB)	(dB)	(dB)	(dB)	dB, (A)
15/2/22	11:15	57	84.7	45.7	51.4	48.1	
15/2/22	11:30	57.1	74.4	46.9	53.9	48.8	
15/2/22	11:45	56.8	70	46.7	53.2	48.7	
15/2/22	12:00	59.2	81.9	45.8	55.1	48.3	58.2
15/2/22	12:15	57.2	69	46.7	53.3	48.5	
15/2/22	12:30	58.9	70.5	46.5	56.1	50	
15/2/22	12:45	57.3	70.5	46.9	54.2	48.6	
15/2/22	13:00	56.7	70.7	46.3	52.8	48.4	57.1
15/2/22	13:15	57	70.4	46.2	53.8	49.1	
15/2/22	13:30	57.6	74.3	45.4	51.6	47.2	
15/2/22	13:45	57.2	70.7	44.8	51.8	47	
15/2/22	14:00	56	69.4	45.2	51.6	46.9	56.1
15/2/22	14:15	56.4	73.2	44.4	51.2	46.4	
15/2/22	14:30	56.7	67.9	44.6	53.5	48.1	
15/2/22	14:45	55.3	68	45.5	50.6	47.3	
15/2/22	15:00	55.2	71.9	46.1	50.3	47.7	55.4
15/2/22	15:15	55.8	72.4	45.9	50.7	47.7	
15/2/22	15:30	55.6	68.3	46.3	51.5	48	
15/2/22	15:45	55.1	72.6	46.2	52.3	48.3	
15/2/22	16:00	55.2	70.9	46	51.5	47.9	55.3
15/2/22	16:15	55.8	73.5	45.8	52.4	48	
15/2/22	16:30	55	78.7	46.1	52.1	48.7	
15/2/22	16:45	55.3	68.2	45.7	51.5	47.7	
15/2/22	17:00	55.1	67.1	45.8	52.3	48.2	56.0
15/2/22	17:15	57.4	83.5	46	53.8	48.6	
15/2/22	17:30	55.2	70.2	46	52.9	48.4	
15/2/22	17:45	55.8	77.6	46.2	51.7	47.9	
15/2/22	18:00	55.2	65.8	45.6	52.7	47.7	54.9
15/2/22	18:15	55.5	70.1	45.8	52.1	47.3	
15/2/22	18:30	55.3	68.9	45.8	52.8	48.8	
15/2/22	18:45	53.2	68.2	45.7	50.9	48.1	
15/2/22	19:00	53.3	65.8	45	50.5	47.2	53.5

15/2/22	19:15	55	73.7	45.4	50.9	47.2	
15/2/22	19:30	53.1	65.2	42.2	49.1	45.3	
15/2/22	19:45	51.9	68.3	42.2	47.5	44.1	
15/2/22	20:00	52.7	65.2	42.6	49	45	
15/2/22	20:15	53	72.2	41.8	48.3	43.9	51.8
15/2/22	20:30	50.8	63.8	41.4	45.4	42.9	
15/2/22	20:45	50.1	71	41	44.7	42.6	
15/2/22	21:00	50.5	62.4	40.1	45.4	42.4	
15/2/22	21:15	50.1	64.4	39.8	44.8	41.7	50.5
15/2/22	21:30	49.3	65.8	39.1	43.8	40.8	
15/2/22	21:45	51.6	65.6	39.9	46	41.7	
15/2/22	22:00	49.1	66.9	38.9	42.8	40.8	
15/2/22	22:15	50.5	64.1	39.1	45	41.2	50.9
15/2/22	22:30	52.3	70	38.5	45.5	40.4	
15/2/22	22:45	51.2	65.7	38.3	43.9	40.6	
	Day 1	55.3	dB $L_{Aeq,T}$				
15/2/22	23:00	47.7	63.6	36.9	40.6	38.7	
15/2/22	23:15	48	68.3	35.4	39.6	37.1	46.4
15/2/22	23:30	45.8	61.5	34	37.8	36	
15/2/22	23:45	42	61.8	34.6	38.1	36.4	
16/2/22	0:00	44	58.9	34.7	38.3	36.6	
16/2/22	0:15	43.3	60.9	33.4	37.6	35.3	43.5
16/2/22	0:30	43.9	64.6	32.4	37.7	35.1	
16/2/22	0:45	42.7	58.8	32.7	38	35.5	
16/2/22	1:00	45.2	61.1	34.6	40.5	36.7	
16/2/22	1:15	43.9	60.3	34.2	38.3	36	44.1
16/2/22	1:30	44.2	68.3	32.1	36.6	34.6	
16/2/22	1:45	42.6	59.2	32.3	37.7	34.5	
16/2/22	2:00	38.7	50.9	32	37.4	34.7	
16/2/22	2:15	37.3	51.4	30	35.5	32.7	38.1
16/2/22	2:30	38.8	53.5	32.1	36.3	34.4	
16/2/22	2:45	37.4	53.4	32.5	36.3	34.3	
16/2/22	3:00	41.7	62.2	33.1	37.8	34.9	
16/2/22	3:15	44.4	64	32.6	37.7	34.6	42.3
16/2/22	3:30	40.4	53.3	33.5	37.6	35.5	
16/2/22	3:45	41.5	61.3	32.8	37.7	34.8	
16/2/22	4:00	41.7	59	33.1	38.1	35.2	
16/2/22	4:15	41.8	58.4	32.6	37.6	35.1	43.7
16/2/22	4:30	45.6	61.9	33.6	39.5	35.7	
16/2/22	4:45	44.3	61.3	33.9	38.5	35.8	

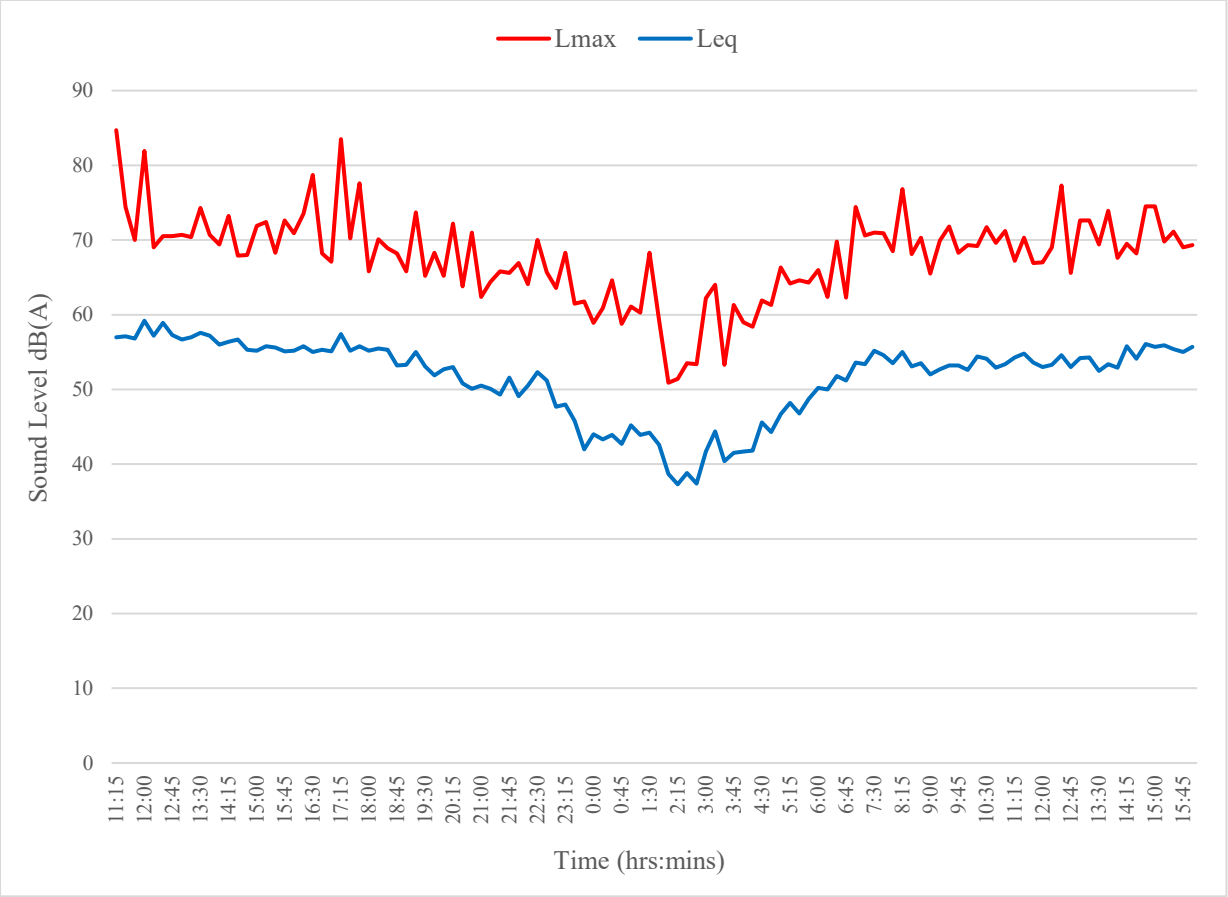
16/2/22	5:00	46.7	66.3	35.3	40.9	38.1	47.7
16/2/22	5:15	48.2	64.2	36.8	42.5	39.6	
16/2/22	5:30	46.8	64.6	37.7	42.9	40	
16/2/22	5:45	48.7	64.3	39.3	44.9	41.9	
16/2/22	6:00	50.2	66	40	45.7	42.9	50.9
16/2/22	6:15	50	62.4	41.3	46.1	43.5	
16/2/22	6:30	51.8	69.8	42.5	48.3	45	
16/2/22	6:45	51.2	62.3	41.4	48.4	44.7	
	Night 1	46.0	dB $L_{Aeq,T}$				
16/2/22	7:00	53.6	74.4	44.1	49.9	46.4	54.3
16/2/22	7:15	53.4	70.6	44.6	51	47.3	
16/2/22	7:30	55.2	71	44.3	52	47.4	
16/2/22	7:45	54.6	70.9	45.1	51.7	47.6	
16/2/22	8:00	53.5	68.5	44.3	50.5	46.7	53.8
16/2/22	8:15	55	76.8	44.2	51.9	47.4	
16/2/22	8:30	53.1	68.1	43.8	49.5	46	
16/2/22	8:45	53.5	70.3	43.3	49.8	46.2	
16/2/22	9:00	52	65.5	42.5	48.3	45.4	52.8
16/2/22	9:15	52.7	69.9	43.4	49.4	45.7	
16/2/22	9:30	53.2	71.8	44.1	50.2	46.7	
16/2/22	9:45	53.2	68.3	45	50.3	47	
16/2/22	10:00	52.6	69.3	44.7	50.2	47	53.6
16/2/22	10:15	54.4	69.2	42.6	51	47.3	
16/2/22	10:30	54.1	71.7	43	50.2	45.8	
16/2/22	10:45	52.9	69.6	43.3	50	46.2	
16/2/22	11:00	53.4	71.2	44.3	50.7	47.3	54.1
16/2/22	11:15	54.3	67.2	44.7	52	47.7	
16/2/22	11:30	54.8	70.3	44.8	52.4	47.2	
16/2/22	11:45	53.6	66.9	44	50.8	47	
16/2/22	12:00	53	67	44.5	51	47.2	53.5
16/2/22	12:15	53.3	69	42.9	50.8	45.5	
16/2/22	12:30	54.6	77.3	42.9	50.4	46	
16/2/22	12:45	53	65.6	44.3	51.1	47	
16/2/22	13:00	54.2	72.6	44	51.1	46.8	53.7
16/2/22	13:15	54.3	72.6	44.6	50.6	46.9	
16/2/22	13:30	52.5	69.4	44.6	50.9	46.8	
16/2/22	13:45	53.4	73.9	44	48.9	46.2	
16/2/22	14:00	52.9	67.6	44.6	49.7	46.9	54.9
16/2/22	14:15	55.8	69.5	46.6	53.4	49	
16/2/22	14:30	54.1	68.2	45.5	52	48.2	

16/2/22	14:45	56.1	74.5	45.2	53.7	49.1	
16/2/22	15:00	55.7	74.5	46.9	53.7	49.8	55.5
16/2/22	15:15	55.9	69.8	44.8	53.9	49	
16/2/22	15:30	55.4	71.1	45	53.3	49.3	
16/2/22	15:45	55	69	47.4	53.2	49.7	
16/2/22	16:00	55.7	69.3	46.3	54	49.9	
	Day 2	54.1	dB $L_{Aeq,T}$				

Ambient Noise Levels

Microphone Position 2 – 10b Burwell Road (Front)

Graph



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APPENDIX 5

Noise Mitigation

Glazing

Sound insulation data for standard products

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Single glazing										
4 mm Float Glass	17	20	26	32	33	26	29 (-2; -3)	29	27	26
6 mm Float Glass	18	23	30	35	27	32	31 (-2; -3)	31	29	28
8 mm Float Glass	20	24	29	34	29	37	32 (-2; -3)	32	30	29
10 mm Float Glass	23	26	32	31	32	39	33 (-2; -3)	33	31	30
12 mm Float Glass	27	29	31	32	38	47	34 (0; -2)	34	34	32
6 mm Laminated Glass	20	23	29	34	32	38	32 (-1; -3)	32	31	29
8 mm Laminated Glass	20	25	32	35	34	42	33 (-1; -3)	33	32	30
10 mm Laminated Glass	24	26	33	33	35	44	34 (-1; -3)	34	33	31
12 mm Laminated Glass	24	27	33	32	37	46	35 (-1; -3)	35	34	32
Insulating glass units										
4 mm / (6 - 16 mm) / 4 mm	21	17	25	35	37	31	29 (-1; -4)	29	28	25
6 mm / (6 - 16 mm) / 4 mm	21	20	26	38	37	39	32 (-2; -4)	32	30	28
6 mm / (6 - 16 mm) / 6 mm	20	18	28	38	34	38	31 (-1; -4)	31	30	27
8 mm / (6 - 16 mm) / 4 mm	22	21	28	38	40	47	33 (-1; -4)	33	32	29
8 mm / (6 - 16 mm) / 6 mm	20	21	33	40	36	48	35 (-2; -6)	35	33	29
10 mm / (6 - 16 mm) / 4 mm	24	21	32	37	42	43	35 (-2; -5)	35	33	30
10 mm / (6 - 16 mm) / 6 mm	24	24	32	37	37	44	35 (-1; -3)	35	34	32
6 mm / (6 - 16 mm) / 6 mm Laminated	20	19	30	39	37	46	33 (-2; -5)	33	31	28
6 mm / (6 - 16 mm) / 10 mm Laminated	24	25	33	39	40	49	37 (-1; -5)	37	36	32

The above are generally accepted values for generic products taken from EN 12758. They are conservative values that can be used in the absence of measured data.

Data for laminated glass is based on pvb interlayers (excluding acoustic pvb interlayers). Glass thickness for laminated glass excludes interlayer thickness.

Data can be adopted for air or argon gas-filled cavities

R_w = Weighted sound reduction. This scale allows for the response of the human ear and could be used for determining a suitable product to reduce noise such as voices.

C = An adjustment to the R_w scale that could be used for selecting a product to reduce noise from music, radio, tv, high speed traffic and other medium to high frequencies.

C_{tr} = An adjustment to the R_w scale that could be used for selecting a product to reduce noise from urban road traffic, disco music and other noises with a large component of low frequencies.

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Noise Mitigation

Glazing

Pilkington **Optiphon**™

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Single glazing										
6.8 mm Pilkington **Optiphon**™	26	27	31	36	40	39	36 (-1; -4)	36	35	32
8.8 mm Pilkington **Optiphon**™	24	28	34	38	37	43	37 (-1; -4)	37	36	33
9.1 mm Pilkington **Optiphon**™	26	29	34	38	38	43	37 (-1; -3)	37	36	34
12.8 mm Pilkington **Optiphon**™	30	32	37	39	41	51	39 (0; -2)	39	39	37
13.1 mm Pilkington **Optiphon**™	30	33	37	40	41	50	40 (0; -2)	40	40	38
Insulating glass units										
6 mm / 16 mm argon / 6.8 mm Pilkington **Optiphon**™	22	27	35	42	41	48	38 (-2; -5)	38	36	33
6 mm / 16 mm argon / 8.8 mm Pilkington **Optiphon**™	24	26	40	48	46	54	41 (-3; -7)	41	38	34
8 mm / 16 mm argon / 9.1 mm Pilkington **Optiphon**™	24	29	41	47	47	55	43 (-3; -7)	43	40	36
10 mm / 16 mm argon / 9.1 mm Pilkington **Optiphon**™	29	33	44	46	49	57	45 (-2; -5)	45	43	40
8.8 mm Pilkington **Optiphon**™ / 16 mm argon / 12.8 mm Pilkington **Optiphon**™	26	36	46	50	52	63	47 (-2; -7)	47	45	40
9.1 mm Pilkington **Optiphon**™ / 20 mm argon / 13.1 mm Pilkington **Optiphon**™	29	39	49	52	55	63	50 (-3; -8)	50	47	42

Measurements undertaken in accordance with BS EN ISO 10140 and R_w (C; C_{tr}) determined in accordance with BS EN ISO 717-1
For insulating glass units, there is little difference in the sound insulation for cavity widths in the range 6 to 16 mm
Pendulum body impact resistance to BS EN 12600 for all Pilkington **Optiphon**™ is Class 1 (B) 1
To achieve low U values in insulating glass units, Pilkington **Optiphon**™ can be combined with low emissivity glass from the Pilkington **K Glass**™ or Pilkington **Optitherm**™ ranges
To calculate performance data for Pilkington products, please use our Spectrum online calculator at www.pilkington.co.uk/spectrum
For glass combinations to achieve an R_w value higher than 50 dB, please contact us for more details

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Noise Mitigation

Glazing

Table 3 – Double Windows (Secondary Sashes)

Thirdoctaveband Centre Frequency (Hz)	Sound Insulation (dB) for Glass Thickness (mm)					
	6/100/4		6/150/4		10/200/6	
100	25		27		32	
125	27	26	30	29	37	35
160	27		30		39	
200	33		34		45	
250	33	34	34	35	46	46
315	37		39		46	
400	41		42		47	
500	46	44	46	45	45	46
630	50		50		45	
800	54		54		44	
1000	57	56	57	56	45	46
1250	59		58		50	
1600	58		58		53	
2000	52	53	52	52	58	56
2500	51		49		58	
3150	48		47		64	
4000	57	52	52	50	64	65
R_m (dB)	44		44		47	
R_w (dB)	46		47		49	
R_{TRA} (dBA)	37		39		45	

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Noise Mitigation

Ventilation

AWV39

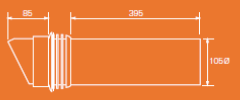
AWV39

Acoustic wall ventilator

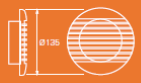
Physical specification

All measurements in millimetres.

External



Side



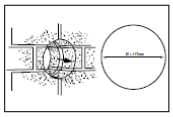
Internal

Weight: 0.7440 kg
Materials: PVC.

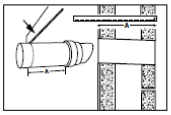
Features

- Acoustic background ventilator
- Provides acoustic attenuation to Dn,e,w 39 dB
- 5000mm² equivalent area performance
- Designed for use in refurbishment applications
- Suitable for wall thicknesses 255 – 370mm²

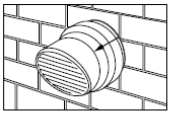
Installation



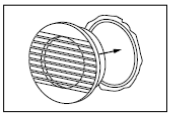
Using a 117mm core drill, cut a hole through wall.



Measure wall thickness and cut down plastic sleeve as required.



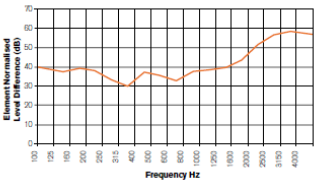
Push the sleeve through the wall. The seal will automatically sit between the sleeve and the external grille, providing a watertight fit.



Push fit internal grille.

Performance

Model	Acoustic Performance Dn,e W (dB)	Equivalent Area mm²
AWV39	39	5000



Dn,e,w (C;Ctr) = 39(0;-2) dB
Dn,e,w (C) = 39dB
Dn,e,w (Ctr) = 37dB
Dn,e,w: Average weighted performance across frequency range
C: Pink Noise
Ctr: Road Noise

Specification

CE MARKED

2 YEAR GUARANTEE

Acoustic: Ventilation

Considering noise and domestic ventilation together

If life was simple then noise issues would be simply dealt with by swapping standard products for acoustic products.

In some circumstances, this may be achievable, however the nature of acoustic products means that they are generally larger and more bulky and multiple installations, (to achieve higher ventilation rates) of the same product can also effect acoustic performance.

With this in mind, noise and ventilation must be considered together at design. Whole house systems that have limited penetrations in the facade of a building often work well, however a whole range of individual products such as airbricks and wall ventilators are available with db reductions of up to 55.

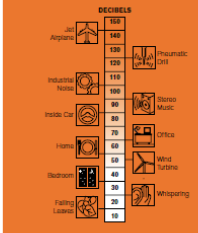
The best thing to do is ask – too many times have buildings been built and then acoustic ventilation been thought about, thus reducing options and sometimes meaning costly re-works on site.

Measuring sound

Sound can be measured in two ways:

- Intensity/Loudness of sound is measured in decibels – dB
- Pitch of sound is measured in frequency of vibrations per second

The decibel scale runs from the faintest sound the human ear can detect (0dB) to over 180dB that is similar to the noise a rocket creates during a launch.



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APPENDIX 6

ProPG: Planning & Noise

Noise Risk Assessment

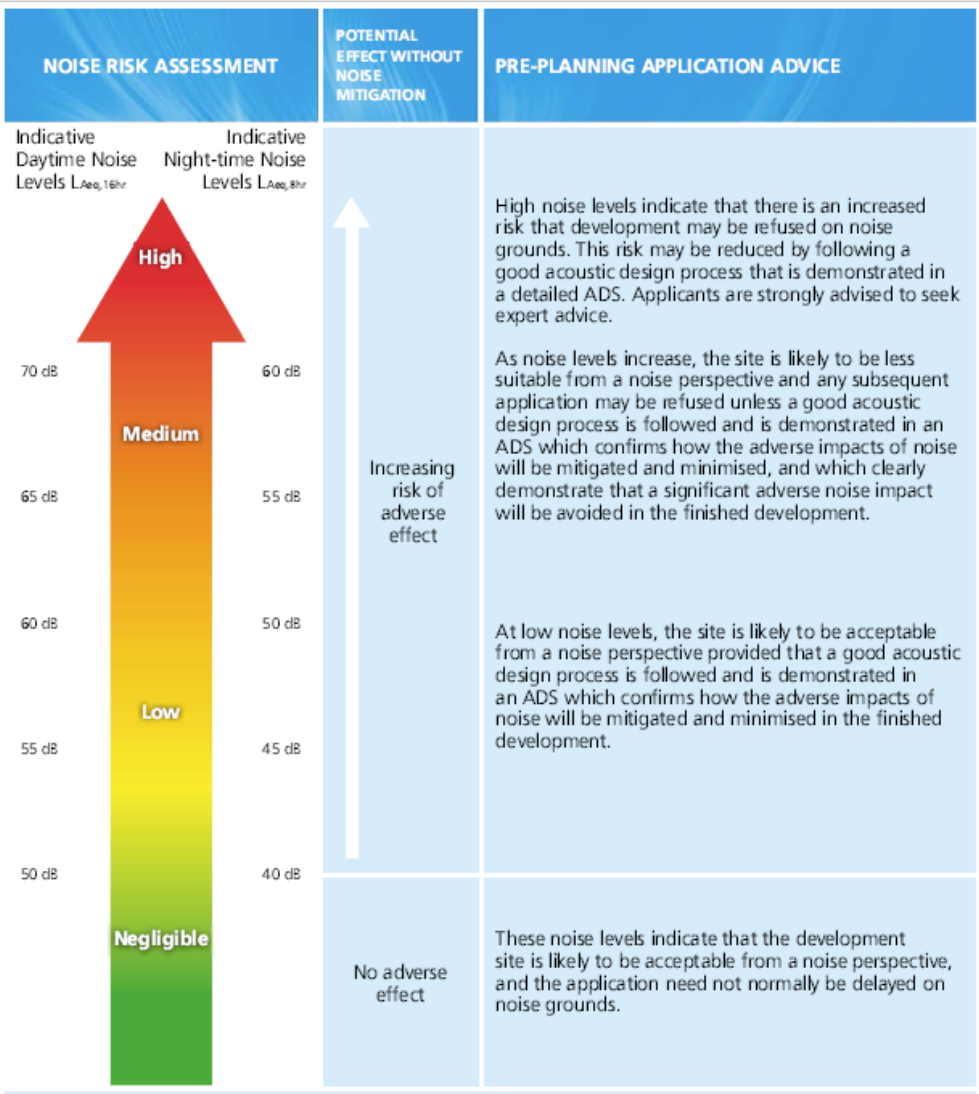

Figure 1. Stage 1– Initial Site Noise Risk Assessment

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ProPG: Planning & Noise

Internal Noise Level Guidelines

ACTIVITY	LOCATION	07:00 – 23:00 HRS	23:00 – 07:00 HRS
Resting	Living room	35 dB $L_{Aeq,16\ hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16\ hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\ hr}$	30 dB $L_{Aeq,8\ hr}$ **45 dB L_{AmaxF}** (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 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue)

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ProPG: Planning & Noise

External Amenity Noise

Element 3 – External Amenity Area Noise Assessment

3(i) "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".

3(ii) "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

3(iii) "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 external amenity spaces."

3(iv) Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process.

3(v) Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:

- *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*
- *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
- *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, publically accessible, external 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 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.*

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ProPG: Planning & Noise

Acoustic Design Statement

Acoustic Design Statement (ADS)

An ADS for new housing should be proportionate to the scale of development and the extent of noise risk at the development site. An ADS should typically address the following issues:

TYPICAL ISSUES FOR LOW NOISE RISK SITES	ADDITIONAL ISSUES FOR MEDIUM/HIGH NOISE RISK SITES
Relevant noise sources identified	Multiple source contributions carefully quantified
Assess extent of noise risk for unmitigated site (current and foreseeable future, 15 years ahead)	Greater coverage across the site (all buildings, all relevant heights)
	Alternative site layouts considered
	Adequate non-sensitive use for screening
Opportunities to mitigate the noise source within the site	Opportunities to mitigate the noise source outside owned land Physical mitigation, operational management
Maximise separation	Existing topographical advantages Change site level
Noise barriers – screening opportunities	Barriers inside and outside the site
Site layout – protecting residential units	Design external amenity spaces (e.g. balconies) to reduce noise entering sensitive rooms
Site layout – protecting external amenity space	Access to quiet open space on or off-site
Non-sensitive elements as screens	Non-sensitive elements designed as screens
Building layout to self-screen sensitive rooms	Orientation of noise sensitive rooms away from the source of noise exposure i.e. quiet facades
Building treatment to screen openings	Consideration of alternative acoustic options
Window location & size on affected facades	Innovative facade and window designs e.g. plenum windows
	Façade insulation design
Ventilation – natural, from quiet facade	Acoustic performance of ventilation, thermal comfort
	Complete Acoustic Design Process throughout

Figure 3. Typical acoustic design issues to be included in an ADS

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ProPG: Planning & Noise

Summary

Summary

3.16 A summary of the overall ProPG approach is provided in ***Figure 4***.

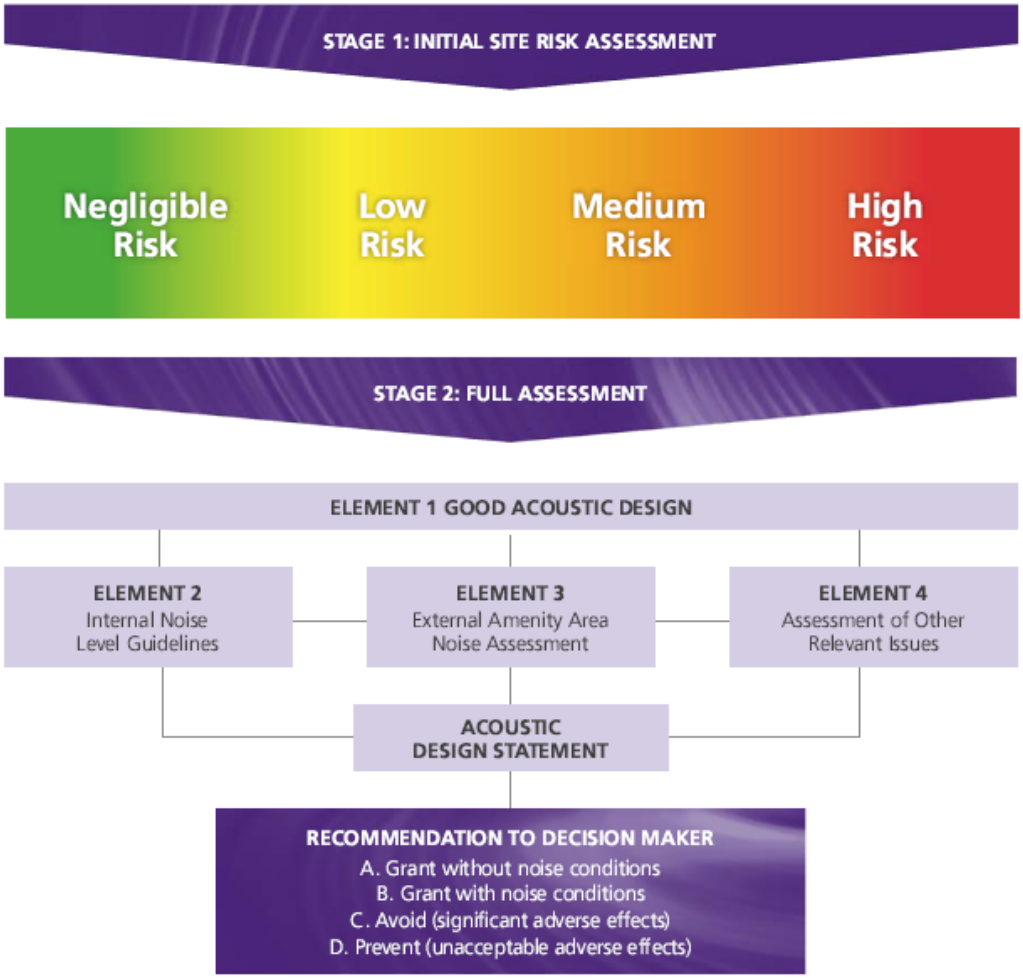

Figure 4 Summary of overall ProPG approach

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APPENDIX 7

Airborne Sound Insulation of Walls & Partitions

BS 8233: 2014

Table E.1A **Laboratory airborne sound insulation of walls and partitions**

Sound insulation R_w dB	Type of wall or partition
26 to 33	a) 1 mm steel sheet panels fixed to steel frame members to form demountable partition units 50 mm overall thickness. Mineral wool cavity insulation.
	b) Plywood or wood fibre board 12 mm thick nailed both sides of (50 × 50) mm timber framing members spaced at 400 mm centres.
	c) Paper faced strawboard or wood wool 50 mm thick panels plastered both sides.
	d) Chipboard hollow panels 50 mm thick tongued and grooved edges, hardboard faced. Joints covered with wood trim.
33 to 37	a) Lightweight masonry blockwork. Plaster or drylining on at least one side. Overall mass per unit area not less than 50 kg/m².
	b) Timber stud partitions any size timbers greater than (50 × 350) mm, 400 mm centres, cross noggins, 9.5 mm plasterboard lining on both sides, any suitable finish.
	c) Metal stud partition, 50 mm studs 600 mm centres, clad both sides with 12.5 mm plasterboard, joints filled and perimeters sealed. Approximate mass per unit area 18 kg/m².
	d) 50 mm lightweight masonry blockwork, plastered both sides to 12 mm thickness or drylined with 9.5 mm plasterboard.
37 to 43	a) Lightweight masonry blockwork, plaster or dry lining on at least one side. Overall mass per unit area not less than 75 kg/m².
	b) Either 75 mm or (100 × 50) mm timber studs (no noggins) spaced 600 mm apart, 50 mm mineral fibre quilt in stud cavity. Frame-lined on both sides with one layer 12.5 mm plasterboard. Approximate mass per unit area 19 kg/m².
	c) Metal stud partition, 50 mm studs 600 mm centres, clad both sides with 15 mm plasterboard, joints filled and perimeters sealed. Approximate mass per unit area 26 kg/m².
43 to 50	a) Masonry wall, joints well filled. Either plaster or dry lining on both sides. Overall mass per unit area not less than 150 kg/m².
	b) 100 mm metal stud partition, "C" section studs not greater than 600 mm spacing, not less than nominal 50 mm web depth. Clad on both sides with two layers of plasterboard of not less than 22 mm combined thickness. Mineral fibre quilt hung between studs. Approximate mass per unit area 35 kg/m².
	c) (75 × 50) mm timber framing using stagged studs at 300 mm spacing with 25 mm stagger forward and back. Frame clad with two layers of 12.5 mm of plasterboard on both sides. Mineral fibre quilt hung between studs. Approximate mass per unit area 36 kg/m².
	d) (50 × 25) mm timber stud partition to form a 25 mm cavity, clad on both sides with minimum 38 mm wood wool slabs having their outer faces screeded or plastered.
	e) Solid autoclaved aerated concrete blocks, 215 mm thick plaster or dry-lined finish on both sides, blockwork joints well filled. Overall mass per unit area not less than 160 kg/m².
50 to 54	a) Two separate frames of timber studs not less than (89 × 38) mm, or boxed metal studwork with 50 mm minimum web depth. Studs at 600 mm maximum centres. A 25 mm mineral wool quilt suspended between frames. Frames spaced to give a minimum 200 mm overall cavity. Clad on outside of each frame with a minimum of 30 mm plasterboard layers (e.g. 19 mm plus 12.5 thickness). Approximate mass per unit area 54 kg/m².
	b) Either in situ or precast concrete wall panel not less than 175 mm thick and not less than 415 kg/m². All joints well filled.

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APPENDIX 8

Meteorological Conditions[18]

Weather History for IENGLAND313

Daily Mode | February | 15 | 2022 | View

Previous

Summary
February 15, 2022

	High	Low	Average
Temperature	47.5 °F	34.1 °F	42.4 °F
Dew Point	46.1 °F	32.3 °F	40.6 °F
Humidity	97 %	85 %	93 %
Precipitation	0.31 in	--	--

	High	Low	Average
Wind Speed	5.9 mph	0.0 mph	2.3 mph
Wind Gust	18.0 mph	--	7.7 mph
Wind Direction	--	--	SSW
Pressure	29.81 in	29.48 in	--

Weather History for IENGLAND313

Daily Mode | February | 16 | 2022 | View

Previous

Summary
February 16, 2022

	High	Low	Average
Temperature	58.2 °F	46.5 °F	53.9 °F
Dew Point	54.0 °F	41.6 °F	50.2 °F
Humidity	98 %	70 %	88 %
Precipitation	0.06 in	--	--

	High	Low	Average
Wind Speed	11.2 mph	2.8 mph	6.1 mph
Wind Gust	33.0 mph	--	17.2 mph
Wind Direction	--	--	South
Pressure	29.49 in	29.26 in	--

[18] Source: www.wunderground.com

Meteorological Conditions[19]

Weather History for IENGLAND313

Daily Mode | February | 17 | 2022 | View

Previous

Summary
February 17, 2022

	High	Low	Average
Temperature	51.9 °F	44.5 °F	47.4 °F
Dew Point	43.5 °F	33.6 °F	38.7 °F
Humidity	84 %	54 %	72 %
Precipitation	0.00 in	--	--

	High	Low	Average
Wind Speed	7.6 mph	0.3 mph	3.7 mph
Wind Gust	24.0 mph	--	11.5 mph
Wind Direction	--	--	SSW
Pressure	29.84 in	29.44 in	--

[19] Source: www.wunderground.com