



**NOS. 25 - 26 MILTON ROAD
GRAVESEND, KENT DA12 2RF
PROPOSED RESIDENTIAL DEVELOPMENT

NOISE IMPACT ASSESSMENT**

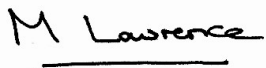
Report No. MRL/100/1421.1v1
December 2018

**NOS. 25 - 26 MILTON ROAD
GRAVESEND, KENT DA12 2RF
PROPOSED RESIDENTIAL DEVELOPMENT**

NOISE IMPACT ASSESSMENT

Report prepared by:
MRL Acoustics Ltd
64 Blackwall Road South
Willesborough Lees
Ashford
Kent
TN24 0FU

On behalf of:
Mr Kalvinder Sandher
c/o 25 – 26 Milton Road
Gravesend
Kent
DA12 2RF

Report prepared by: Matthew Lawrence MSc MIOA – Principal Consultant	
---	---

CONTENTS

	Page
1.0 INTRODUCTION	1
2.0 DESCRIPTION OF THE SITE	2
3.0 NOISE LEVEL SURVEY	3
4.0 ASSESSMENT OF NOISE IMPACT	6
5.0 RECOMMENDED SCHEME OF NOISE MITIGATION MEASURES	13
6.0 SUMMARY AND CONCLUSIONS	17
 APPENDIX I – NOISE UNITS AND INDICES	 19
APPENDIX II – RESULTS OF NOISE LEVEL SURVEY	22
APPENDIX III – NOISE BREAK-IN CALCULATIONS	25

1.0 INTRODUCTION

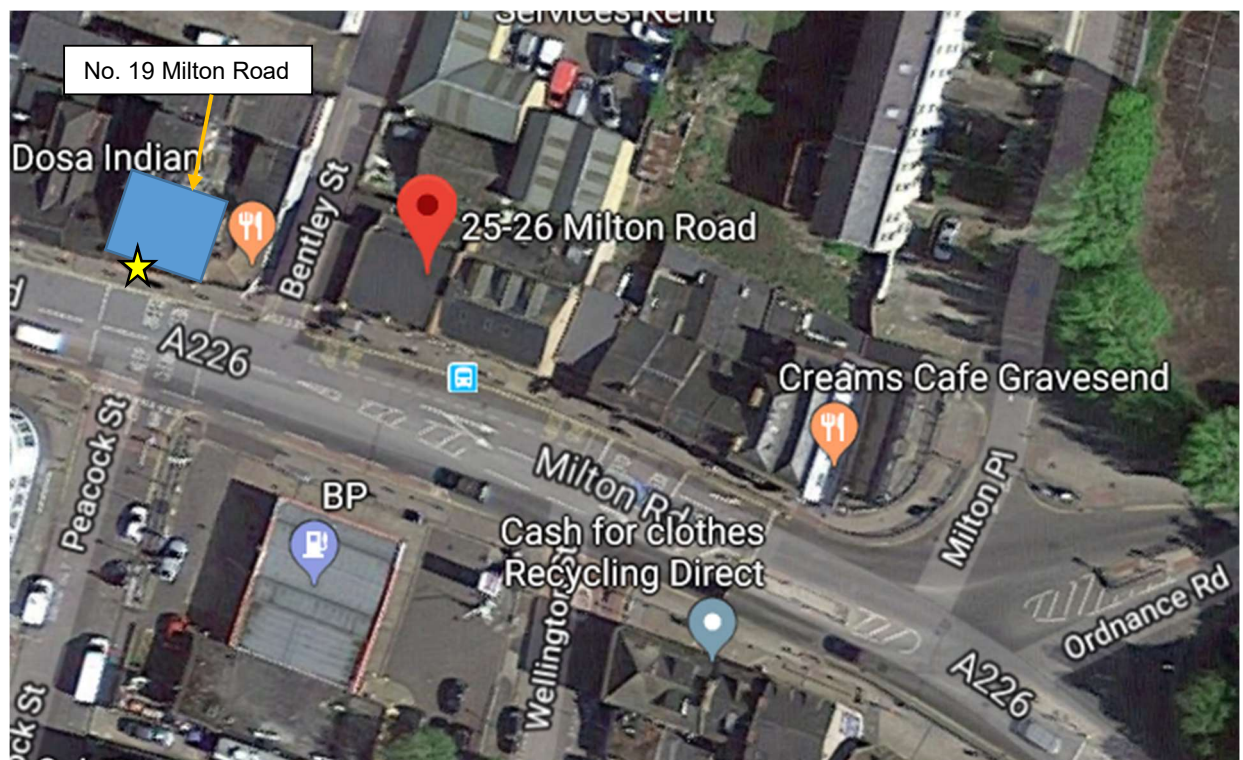
- 1.1 MRL Acoustics Limited was commissioned by Mr Kalvinder Sandher to assess the impact of noise on a proposed residential development scheme at Nos. 25 - 26 Milton Road, Gravesend, Kent DA12 2RF.
- 1.2 The scheme comprises the conversion of the existing 1st floor level of the building from its current use as a restaurant area into 2 no. self-contained flats.
- 1.3 The assessment has included:-
- measurements of the existing ambient noise climate at the front elevation of an adjacent site (No. 19 Milton Road) over a full 24-hour period for road traffic noise;
 - assessment of the noise impact on the development in accordance with the National Planning Policy Framework; the Noise Policy Statement For England; the WHO Guidelines; BS 8233 : 2014; and ProPG : Planning & Noise - May 2017;
 - recommendation of an appropriate noise mitigation scheme for the new dwellings, if necessary;
- 1.4 This report outlines our findings and our recommendations.
- 1.5 Noise levels referred to in the text have been rounded to the nearest whole decibel (dB), as fractions of decibels are imperceptible.
- 1.6 An explanation of the various noise units, indices and acoustical terms used in this report is provided in Appendix I.

2.0 DESCRIPTION OF THE SITE

- 2.1 The site is at Nos. 25 - 26 Milton Road, Gravesend, Kent, located on the northern side of Milton Road, directly opposite the junction with Wellington Street. The building comprises a Steak House restaurant and bar on the ground floor and a large seating area on the 1st floor level.
- 2.2 The ground floor commercial unit will be retained and the entire 1st floor level converted into residential use. The existing 2nd floor level comprises residential accommodation already and does not form part of the development scheme.
- 2.3 Milton Road is a busy main road leading in and out of Gravesend town centre with steady levels of road traffic throughout the daytime period, including numerous HGVs and buses.
- 2.4 There are existing residential properties located at the upper levels of many of the nearby buildings along this part of Milton Road. On the other side of Milton Road at the corner with Wellington Street is an Esso petrol station and food shop.
- 2.5 The area is a mixture of residential and commercial properties situated along a typical busy urban main road leading in and out of Gravesend town centre.
- 2.6 As a result, it was observed whilst setting up the noise monitoring equipment, that the dominant noise source affecting the front of the development site was road traffic noise along Milton Road.
- 2.7 Directly to the rear of the site is a high brick wall of an existing building. There is no rear amenity area to the site and the rear elevation does not directly overlook any industrial or commercial properties.
- 2.8 The site layout plan is shown at the end of this report.

3.0 NOISE LEVEL SURVEY

- 3.1 MRL Acoustics has already undertaken a 24-hour noise level survey for a similar development at No. 19 Milton Road, Gravesend (report reference MRL/100/1414.1v1 dated November 2018).
- 3.2 As this previous site is only 20m distance from Nos. 25 – 26 Milton Road, with exactly the same noise exposure onto Milton Road, then it is considered reasonable that the results obtained from that first noise survey for No. 19 are representative of the noise climate experienced at Nos. 25 – 26 Milton Road.
- 3.3 A noise level survey was carried out over a full 24-hour period from 10:42 hours on Wednesday 21st November 2018 until 10:45 hours on Thursday 22nd November 2018 in order to establish the general daytime and night-time ambient noise climate of the area.
- 3.4 The noise measurements were taken at 1st floor window level on the front elevation of No. 19 Milton Road overlooking the road. This location was chosen in order to represent the windows of the proposed dwellings that will be affected by the highest levels of environmental noise. The noise monitoring location is shown on the site plan below:-



Noise Measurement Location ★

- 3.5 The noise survey was carried out using a Rion NA-28 Type 1 Sound Level Meter (serial no. 01291241) fitted within an environmental weather-proof case.
- 3.6 The calibration level of the meter was checked before and after the survey to a level of 94.0 dB with a Rion NC-74 sound calibrator (serial no. 35094450) with no variation in the levels observed.
- 3.7 The microphone was fitted on a metal boom and tripod out of a 1st floor window, approximately 1m distance from the facade of the building and was fitted with a Rion WS-15 weather-proof windshield at all times.
- 3.8 The noise measurements consisted of consecutive 15-minute samples of noise over a continuous 24-hour period.
- 3.9 The weather conditions for the survey were generally warm and dry with a light breeze throughout. The temperature at the start of the survey was measured as 18° Celsius and the wind speed was less than 1m/second which represented acceptable conditions for noise measurements.
- 3.10 The noise survey was generally carried out in accordance with the requirements outlined in BS 7455 – 1 : 2003 for environmental noise surveys.
- 3.11 The measured results are ‘facade’ levels as the microphone was within 3.5m of a reflective surface (other than the ground) and therefore a -2.5 dB façade correction is applicable to the measured results to convert them to ‘free-field’ levels in order to assess the noise impact in accordance with BS 8233 : 2014.

Results

- 3.12 The measured ‘facade’ levels are detailed in Appendix II at the end of this report and the corrected ‘free-field’ levels are summarised in Table 1 below:-

Table 1: Corrected 'Free-Field' Noise Levels

Location	Time Period	Noise Levels (dB)		
		L _{Aeq}		L _{Amax} (Average)
		Day (07:00 – 23:00)	Night (23:00 – 07:00)	Night (23:00 – 07:00)
Front Elevation 1 st Floor Level	24-Hours	69	66	79

4.0 ASSESSMENT OF NOISE IMPACT

National Planning Policy Framework (NPPF)

4.1 National Government Guidance has recently become available in the form of the National Planning Policy Framework (NPPF). The NPPF sets out the Government's planning policies for England and how these are expected to be applied.

4.2 Paragraph 123 of section 11 of the NPPF, 'Conserving and enhancing the natural environment' provides general guidance regarding planning and noise. It states:-

Planning policies and decisions should aim to:-

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- Recognise that development will often cause some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established, and;
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

4.3 The NPPF and its accompanying Explanatory Note provide only general guidance on planning and noise.

The Noise Policy Statement for England 2010 (NPSE)

- 4.4 The aim of the NPSE document is to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.
- 4.5 There are several key phrases within the NPSE aims and these are “significant adverse” and “adverse”.
- 4.6 There are two established concepts that are currently being applied to noise impacts, for example, by the World Health Organisation, which are:-

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

Extending these concepts for the purpose of the NPSE leads to the concept of a significant observed adverse effect level.

- 4.7 It is considered that with the provision of a suitable scheme of noise mitigation measures that the noise impact from road traffic and any other environmental noise sources upon the proposed dwellings should be low enough to be classified as being of ‘No Observed Effect Level’ under the NPSE.

Professional Practice Guidance On Planning & Noise (ProPG)

- 4.8 The Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The National Planning Policy Framework (NPPF) encourages improved standards of design. The CIEH, IOA and the ANC have worked together to produce this guidance which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.
- 4.9 This ProPG provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers. It aims to complement Government planning and noise policy and guidance. In particular, it strives to:
- advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
 - encourage the process of **good acoustic design** in and around new residential developments;
 - outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
 - improve understanding of how to determine the extent of potential noise impact and effect; and assist the delivery of sustainable development.
- 4.10 Based on the measured free-field indicative daytime noise level of 69 dB L_{Aeq} (16-Hour) and the free-field indicative night-time noise level of 66 dB L_{Aeq} (8-Hour), the site can be classified as being of 'High Risk' according to Figure 1 of the ProPG document.
- 4.11 Figure 1 of the ProPG document and also Figure 2 of the ProPG document indicating the internal noise level guidelines are reproduced on the following pages.

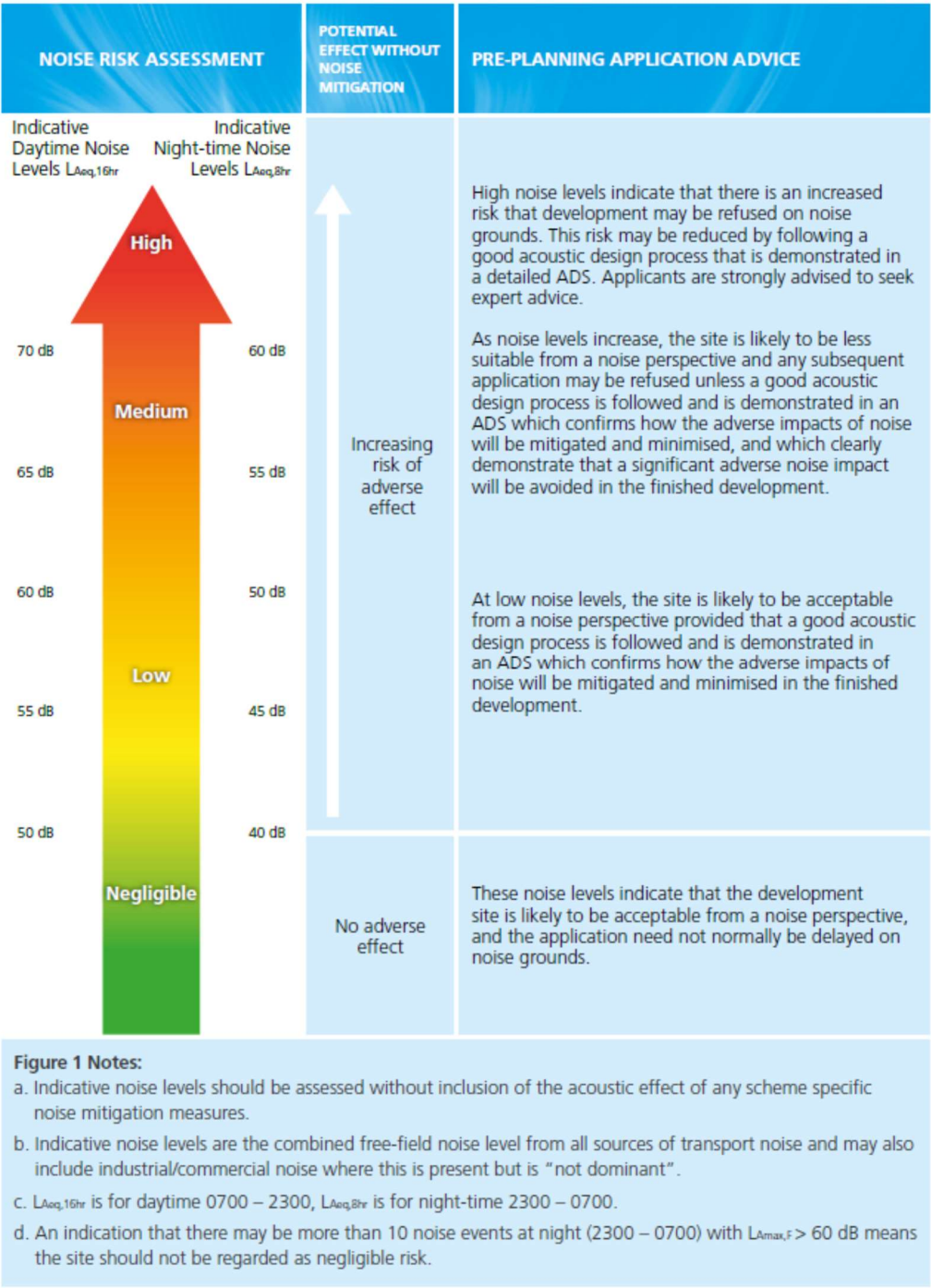


Figure 1. Stage 1– Initial Site Noise Risk Assessment

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

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

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

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

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

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

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

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

Figure 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue)

British Standard 8233 : 2014

- 4.12 Guidance on acoustic design goals for new residential developments is set out in British Standard 8233 : 2014 '*Guidance on sound insulation and noise reduction for buildings*'. The World Health Organisation '*Guidelines for Community Noise*' and the ProPG guidance generally concurs with the recommendations of BS 8233 : 2014. The criteria are summarised in Table 2 below:-

Table 2: BS 8233 Recommended Acoustic Design Criteria

Location	Internal Noise Levels	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Living Room	35 dB L _{Aeq}	-
Dining Room	40 dB L _{Aeq}	-
Bedroom	35 dB L _{Aeq}	30 dB L _{Aeq}
Garden	Desired Limit Not Exceeding 50 dB L _{Aeq} Upper limit of 55 dB L _{Aeq}	

Assessment of Noise Impact

- 4.13 The results of the noise level survey indicate that at the noise monitoring position on the front elevation facing onto Milton Road, the site is exposed to a daytime external noise level of 69 dB L_{Aeq}.
- 4.14 For the night-time period, the front of the site is exposed to an external noise level of 66 dB L_{Aeq} and an average maximum noise level of 79 dB L_{Amax}.

- 4.15 Allowing -15 dB attenuation for an open window, based on the measured daytime noise level of 69 dB L_{Aeq} , the resultant internal noise level within habitable rooms during the daytime will be 54 dB L_{Aeq} (69 dB – 15 dB).
- 4.16 For the night-time period, allowing -15 dB attenuation for an open window, based on the measured night-time noise level of 66 dB L_{Aeq} , the resultant internal noise level within bedrooms will be 51 dB L_{Aeq} (66 dB – 15 dB).
- 4.17 Therefore, with windows open, the internal noise limits outlined within BS 8233 : 2014 of 35 dB L_{Aeq} within living rooms and bedrooms and 40 dB L_{Aeq} within dining rooms during the daytime will be exceeded.
- 4.18 At night-time with the windows open the 30 dB L_{Aeq} criteria in bedrooms will be exceeded by around 21 dB(A).
- 4.19 Therefore, a scheme of noise mitigation measures is required in order to reduce both daytime and night-time internal noise levels.
- 4.20 Our recommendations are set out in Section 5.0.

5.0 RECOMMENDED SCHEME OF NOISE MITIGATION MEASURES

5.1 Table 3 below provides information on the typical sound insulation performance of various glazing specifications:-

Table 3: Sound Insulation of Typical Windows

Description	Weighted Sound Reduction Index, R_w
Any type of window in a facade when partially open	15
Single glazed windows (4mm glass)	29
Single glazed windows (6mm glass)	31
Double glazed units (4-16-4)	33
Double glazed units (4-16-6)	35
Double glazed units (6-16-6)	36
Double glazed units (4-16-6.4mm laminated glass)	39
Secondary glazed windows (4-100-4)	35 - 40
Secondary glazed windows (6-200-6)	40 - 45

5.2 Therefore, for all habitable rooms with a view onto Milton Road, we would recommend that the glazing should consist of minimum construction of 4mm glass – nominal 16mm air gap – 6.4mm acoustic laminated glass.

5.3 Based on the measured external noise levels and the typical Sound Reduction Index for the recommended glazing (4/16/6.4 laminated), we have calculated that the external daytime noise climate of 69 dB L_{Aeq} should be attenuated to 30 dB L_{Aeq} in lounges, dining rooms and bedrooms with the windows closed.

5.4 The night-time noise level of 66 dB L_{Aeq} should be attenuated to approximately 28 dB L_{Aeq} within bedrooms with the windows closed.

5.5 The noise break-in calculations are shown in Appendix III at the end of this report.

- 5.6 For the windows on the rear elevation, we would recommend that standard thermal double-glazed units of 4mm glass – 16mm nominal air gap – 4mm glass would provide sufficient sound reduction (33 dB R_w) to ensure that any noise break-in from the rear is below 30 dB L_{Aeq} with the windows closed.
- 5.7 With regard to individual event maximum noise levels BS 8233 states:-
- “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.”
- 5.8 The WHO Guidelines for Community Noise give a specific maximum internal noise level of 45 dB L_{Amax} that should not normally be exceeded more than 10 -15 times per night.
- 5.9 The ProPG guidance states that in noise-sensitive rooms at night, e.g. bedrooms, individual noise events (from all sources) should not normally exceed 45 dB L_{Amax} more than 10 times per night as this represents a threshold below which the effects of individual noise events on sleep can be regarded as negligible.
- 5.10 If we therefore remove the 10 no. highest measured L_{Amax} noise levels obtained between 23:00 – 07:00 hours from the results table shown in Appendix II, the 11th highest recorded night-time level is 82 dB L_{Amax} .
- 5.11 External maximum noise levels of 82 dB(A) would result in internal maximum levels of around 44 dB(A) with the windows closed (based on 4mm glass – 16mm air gap – 6.4mm laminated glass configuration).
- 5.12 The detailed noise survey results in Appendix II indicate that for the rest of the night-time period, the maximum levels did not exceed the 11th highest recorded level of 82 dB(A) therefore, for this particular development scheme, the WHO criteria and ProPG guidance limits for L_{Amax} levels at night should be achieved with windows closed.

Ventilation

- 5.13 Since opening the windows would reduce the sound insulation of the building envelope, it is considered that an acoustically treated alternative method of ventilation should be provided for all affected living rooms, dining rooms and bedrooms.
- 5.14 This approach, which is recommended in BS 8233 : 2014, would provide the new residents with the option of ventilating rooms whilst maintaining the sound insulation of the building envelope.
- 5.15 For the living room, dining rooms and bedroom windows **throughout the development**, acoustically treated ventilation will be required to meet the required internal noise limits without the need to open the windows for ventilation and cooling.
- 5.16 Standard slot-frame trickle-vents **should not** be fitted to the windows outlined above.
- 5.17 We therefore recommend provision of one of the following acoustic ventilation options:-
- acoustically screened wall mounted mechanical (i.e. powered) acoustic ventilators such as Titon 'Sonair F+' or Silavent Energex SHHRV units; or
 - a fully ducted passive or mechanical ventilation system with appropriate sound attenuation measures incorporated into the design; or
 - Titon – HRV 2 Q Plus (MVHR) system 4 - This system is a 'whole house' continuous ventilation system that does not use trickle vents and is considered to be acceptable for this development; or
 - Silavent HRX MVHR 'whole house' Heat Recovery Unit; or
 - any other similar performing acoustic ventilators or ventilation system.
- 5.18 However, we would recommend that the ventilation requirements are checked with the Local Authority Building Control Officer at an early stage.

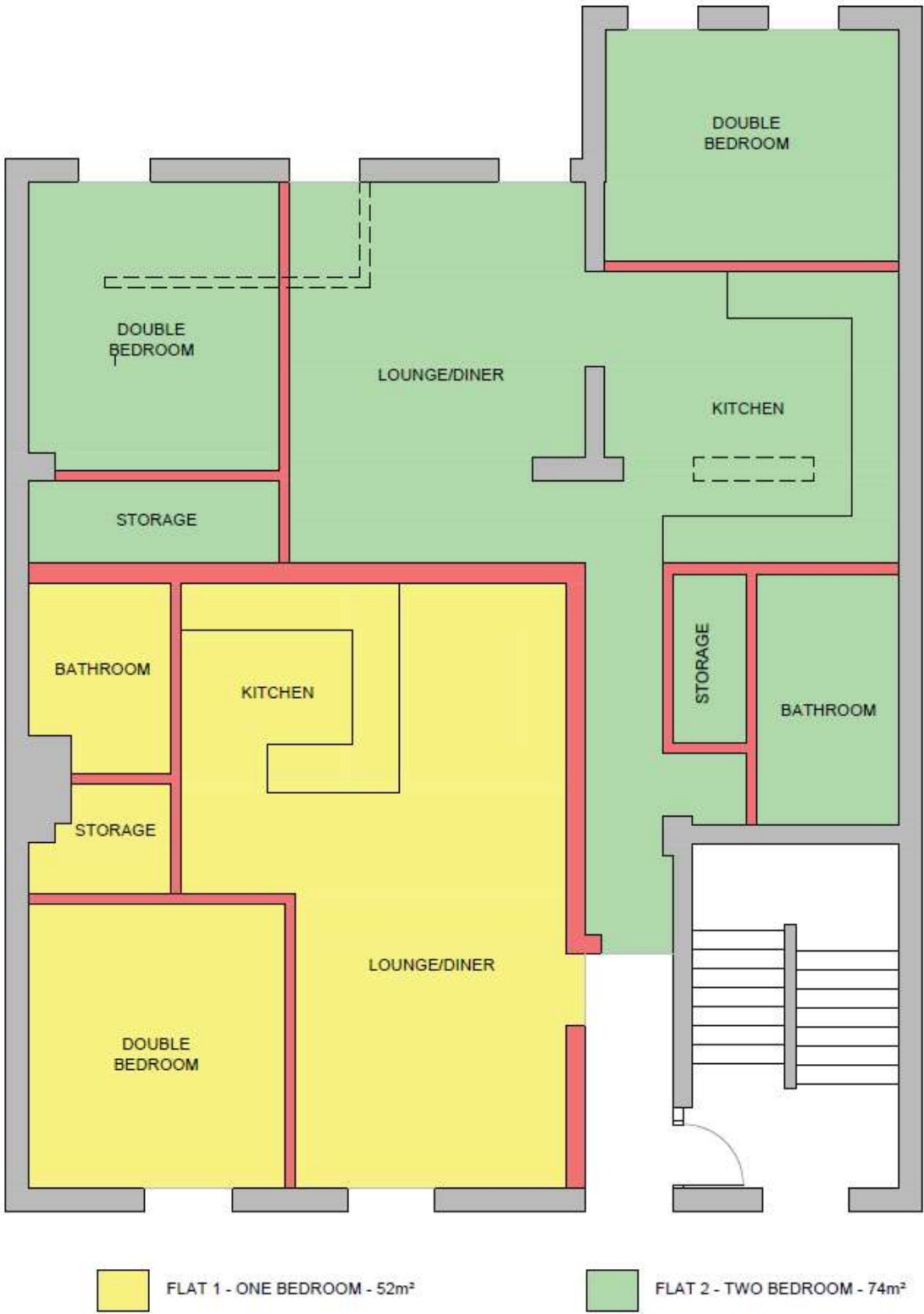
- 5.19 It is considered that provision of any one of the above ventilation schemes should provide sufficient sound insulation from road traffic noise, commercial noise, and any other local noise sources to ensure that the required internal noise limits are achieved.

External Areas

- 5.20 For this particular development, there are no proposed external amenity areas.
- 5.21 Therefore, no further assessment is required in relation to the general outdoor daytime noise limit of 55 dB L_{Aeq} outlined in BS 8233, the WHO Guidelines and the ProPG guidance.

6.0 SUMMARY AND CONCLUSIONS

- 6.1 The impact of noise has been assessed for the proposed residential development scheme at Nos. 25 - 26 Milton Road, Gravesend, Kent DA12 2RF.
- 6.2 The results of the noise level survey and assessment for a very similar close site at No. 19 Milton Road indicate that the development site is exposed to fairly high levels of external environmental noise during both the daytime and the night-time periods.
- 6.3 An appropriate noise mitigation scheme has been recommended for the new dwellings which should provide sufficient noise attenuation to meet the required internal acoustic criteria and fully protect the amenity of future residents in accordance with the standards outlined in BS 8233 : 2014 and the ProPG guidance document.



25-26 MILTON ROAD
OPTION 2
(1:50)

APPENDIX I – NOISE UNITS AND INDICES

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

b) Frequency and hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

c) A-weighting

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters and is denoted dB(A) or dBLA.

d) Glossary of Terms

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below:-

L_{Aeq} The A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period.

L_{Amax} The maximum A-weighted noise level recorded during the monitoring period.

L_{A10} The A-weighted noise level exceeded for 10% of the specified time period. L_{A10} is most often used as a measure of traffic noise.

L_{A90} The A-weighted noise level exceeded for 90% of the specified time period. L_{A90} is used as a measure of 'background noise'.

SEL The 'sound exposure level' of a single event (such as a passing train) and is the L_{Aeq} value of the whole event normalised to a 1 second period level of a sound.

- RT Measured reverberation time in receiver room in seconds.
- RT_0 Standard reverberation time of 0.5 seconds.
- D Level difference, effectively $D = \text{source level} - (\text{receiver level corrected for background level})$.
- D_{nT} Standardised level difference, standardised to a receiver room reverberation time of 0.5 seconds, $D_{nT} = D + 10 \log (RT/RT_0)$.
- $D_{nT,w}$ Weighted standardised level difference, a single figure generated by comparing the D_{nT} with a reference curve. The reference curve is shifted in 1dB steps until the sum of adverse deviation of the test curve, compared to the reference curve, is as large as possible, but no more than 32.0 dB. The value of the shifted reference curve at 500Hz is taken as the $D_{nT,w}$. N.B. As $D_{nT, w}$ for airborne transmission represents a level difference, an improvement generates a larger figure.
- C_{tr} A 'spectrum adaptation term' used to correct the $D_{nT,w}$ in order to reflect low frequency performance of the wall or floor tested.

APPENDIX II – RESULTS OF NOISE LEVEL SURVEY

Date: Wednesday 21st November – Thursday 22nd November 2018

Equipment: Rion NA-28 'Class 1' sound level meter, Rion NC-74 Acoustic Calibrator, environmental weather case, Rion WS-15 windshield, microphone, tripod, metal boom

Weather: Generally warm and dry with a light breeze throughout

Results: All values in dB(A)

Table A1: Front Elevation - Results of 24-Hour Ambient Noise Level Survey

Date	Time	Leq	Lmax	L10	L90	SPL Time Weighting	Frequency Weighting
21/11/2018	10:42	70.10	81.60	73.20	57.20	Fast	A
21/11/2018	10:45	70.60	97.00	73.30	61.80	Fast	A
21/11/2018	11:00	70.50	82.00	74.10	60.10	Fast	A
21/11/2018	11:15	70.40	89.10	73.60	60.80	Fast	A
21/11/2018	11:30	70.40	83.20	73.60	62.80	Fast	A
21/11/2018	11:45	70.10	80.60	73.50	62.50	Fast	A
21/11/2018	12:00	70.20	83.30	73.60	60.90	Fast	A
21/11/2018	12:15	69.80	80.90	73.10	61.70	Fast	A
21/11/2018	12:30	70.00	82.30	73.40	62.60	Fast	A
21/11/2018	12:45	80.90	104.10	74.10	63.40	Fast	A
21/11/2018	13:00	70.40	89.20	73.30	62.70	Fast	A
21/11/2018	13:15	78.20	102.80	73.70	62.40	Fast	A
21/11/2018	13:30	70.60	83.30	74.00	62.20	Fast	A
21/11/2018	13:45	70.50	85.70	73.50	63.80	Fast	A
21/11/2018	14:00	69.90	81.90	73.20	61.50	Fast	A
21/11/2018	14:15	71.00	83.90	74.00	62.80	Fast	A
21/11/2018	14:30	69.70	88.10	72.80	61.40	Fast	A
21/11/2018	14:45	71.10	90.30	73.60	64.50	Fast	A
21/11/2018	15:00	70.00	90.40	72.60	61.40	Fast	A
21/11/2018	15:15	70.10	92.30	73.20	61.80	Fast	A
21/11/2018	15:30	69.90	81.90	73.00	63.10	Fast	A
21/11/2018	15:45	70.10	80.30	73.30	63.90	Fast	A
21/11/2018	16:00	68.50	83.60	72.50	61.60	Fast	A
21/11/2018	16:15	69.80	83.40	73.00	63.40	Fast	A
21/11/2018	16:30	70.60	87.70	73.20	63.90	Fast	A
21/11/2018	16:45	70.30	83.00	73.30	63.80	Fast	A
21/11/2018	17:00	71.00	96.20	72.80	62.50	Fast	A
21/11/2018	17:15	69.60	84.10	72.70	63.40	Fast	A
21/11/2018	17:30	70.00	90.30	73.00	63.20	Fast	A
21/11/2018	17:45	70.70	88.20	73.70	63.40	Fast	A
21/11/2018	18:00	69.50	82.10	72.60	63.80	Fast	A

21/11/2018	18:15	71.20	93.50	73.20	63.30	Fast	A
21/11/2018	18:30	69.70	79.30	73.00	63.50	Fast	A
21/11/2018	18:45	70.60	93.30	73.00	62.90	Fast	A
21/11/2018	19:00	69.20	80.80	72.50	61.00	Fast	A
21/11/2018	19:15	69.90	80.50	73.40	62.20	Fast	A
21/11/2018	19:30	70.40	80.40	74.10	62.00	Fast	A
21/11/2018	19:45	69.70	79.30	73.30	60.50	Fast	A
21/11/2018	20:00	69.60	80.30	73.40	59.80	Fast	A
21/11/2018	20:15	68.80	80.60	73.00	57.60	Fast	A
21/11/2018	20:30	69.00	78.50	73.00	58.90	Fast	A
21/11/2018	20:45	68.70	78.70	72.80	56.70	Fast	A
21/11/2018	21:00	69.30	80.10	73.80	56.10	Fast	A
21/11/2018	21:15	69.60	81.30	73.50	59.80	Fast	A
21/11/2018	21:30	68.00	80.40	72.30	55.90	Fast	A
21/11/2018	21:45	68.80	80.60	73.40	55.00	Fast	A
21/11/2018	22:00	68.70	80.70	73.60	52.60	Fast	A
21/11/2018	22:15	67.30	79.00	72.10	53.40	Fast	A
21/11/2018	22:30	68.20	82.20	72.60	53.20	Fast	A
21/11/2018	22:45	65.90	82.20	70.80	48.50	Fast	A
21/11/2018	23:00	66.80	83.40	71.70	48.40	Fast	A
21/11/2018	23:15	64.80	81.60	68.90	48.10	Fast	A
21/11/2018	23:30	64.90	81.90	69.10	48.00	Fast	A
21/11/2018	23:45	63.50	79.00	68.10	46.30	Fast	A
22/11/2018	00:00	64.60	80.90	69.80	46.00	Fast	A
22/11/2018	00:15	63.40	76.90	68.20	47.00	Fast	A
22/11/2018	00:30	63.80	80.20	67.90	45.50	Fast	A
22/11/2018	00:45	61.30	78.80	61.90	38.10	Fast	A
22/11/2018	01:00	60.60	80.40	61.10	37.90	Fast	A
22/11/2018	01:15	61.40	79.30	63.60	39.50	Fast	A
22/11/2018	01:30	61.20	81.50	61.00	38.00	Fast	A
22/11/2018	01:45	56.90	77.20	57.20	38.30	Fast	A
22/11/2018	02:00	75.10	81.90	78.00	38.90	Fast	A
22/11/2018	02:15	69.40	82.00	77.30	38.30	Fast	A
22/11/2018	02:30	59.60	78.30	61.70	36.80	Fast	A
22/11/2018	02:45	60.20	81.10	58.60	36.20	Fast	A
22/11/2018	03:00	59.70	82.00	58.80	37.60	Fast	A
22/11/2018	03:15	60.60	79.80	61.10	37.90	Fast	A
22/11/2018	03:30	64.20	83.80	67.10	39.40	Fast	A
22/11/2018	03:45	60.50	78.20	63.10	38.90	Fast	A
22/11/2018	04:00	62.60	78.80	66.00	42.90	Fast	A
22/11/2018	04:15	63.40	81.90	67.30	40.10	Fast	A
22/11/2018	04:30	63.50	82.10	66.70	39.70	Fast	A
22/11/2018	04:45	65.90	80.60	70.30	51.10	Fast	A
22/11/2018	05:00	67.80	81.30	72.60	51.80	Fast	A
22/11/2018	05:15	69.10	82.90	73.70	53.90	Fast	A
22/11/2018	05:30	77.00	84.10	79.20	62.00	Fast	A
22/11/2018	05:45	71.10	81.90	75.20	61.10	Fast	A
22/11/2018	06:00	71.00	84.10	75.00	58.70	Fast	A
22/11/2018	06:15	71.90	89.60	75.40	62.60	Fast	A
22/11/2018	06:30	71.50	86.80	74.90	62.60	Fast	A
22/11/2018	06:45	72.10	85.40	75.60	63.30	Fast	A
22/11/2018	07:00	72.10	83.20	75.50	65.90	Fast	A

22/11/2018	07:15	71.80	84.20	75.30	63.60	Fast	A
22/11/2018	07:30	72.30	81.50	75.60	64.80	Fast	A
22/11/2018	07:45	71.60	82.30	75.00	63.80	Fast	A
22/11/2018	08:00	71.50	83.50	74.70	64.60	Fast	A
22/11/2018	08:15	70.80	83.70	74.10	63.70	Fast	A
22/11/2018	08:30	71.50	94.20	74.40	64.80	Fast	A
22/11/2018	08:45	71.20	86.20	74.30	64.80	Fast	A
22/11/2018	09:00	70.50	82.90	74.20	62.10	Fast	A
22/11/2018	09:15	70.20	83.10	73.70	61.90	Fast	A
22/11/2018	09:30	71.30	93.00	74.70	62.60	Fast	A
22/11/2018	09:45	70.70	82.60	74.20	62.40	Fast	A
22/11/2018	10:00	70.30	82.30	73.50	62.60	Fast	A
22/11/2018	10:15	71.50	78.90	75.00	63.70	Fast	A
22/11/2018	10:30	70.60	85.10	74.50	62.50	Fast	A

APPENDIX III – NOISE BREAK-IN CALCULATIONS

BS8233 Calculation of Noise Break-in : Daytime

Project Number: MRL/100/1414.1v1

Description: No. 19 Milton Road, Gravesend, Kent

Consultant: Matt Lawrence



Term	Term Description	Value
S_f	Facade area (incl. window) (m ²)	12.0
S_{wi}	Area of the windows (m ²)	1.0
S_{tr}	Area of the ceiling (m ²)	16.0
S_{ew}	Area of the external wall (m ²)	11.0
S	Area of facade and roof	28.0
x	Room Dimension x	4.0
y	Room Dimension y	4.0
z	Room Dimension z	3.0
RT	Receiving Room RT	0.5
K	Facade correction	0.0

BS8233 Result 30 dB(A)

 L_{Aeq} Result 30 dB(A)

Term	Term Description	Description	Octave Band Centre Frequency								Broadband
			63	125	250	500	1000	2000	4000	8000	
A	$L_{eq,ff}$	Free-field L_{eq} outside room	Enter the Octave Band L_{eq} Data								69
	$D_{n,e}$	Insulation of the trickle vent	Ignore Trickle Vent								
B	$\frac{A_0}{S} 10^{-\frac{D_{n,e}}{10}}$		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
	R_{wi}	SRI of the window	4:12:6.4 mm Stadip Silence								
			100	24	22	29	40	44	46	100	
C	$\frac{S_{wi}}{S} 10^{-\frac{R_{wi}}{10}}$		0.00000	0.00014	0.00023	0.00004	0.00000	0.00000	0.00000	0.00000	
	R_{ew}	SRI of the external wall	BS8233 Example - Brick and block external wall								
			100	40	44	45	51	56	100	100	
D	$\frac{S_{ew}}{S} 10^{-\frac{R_{ew}}{10}}$		0.00000	0.00004	0.00002	0.00001	0.00000	0.00000	0.00000	0.00000	
	R_{tr}	SRI of roof/ceiling	Tiled/slatted roof, 25mm plasterboard ceiling, 100mm quilt above ceiling								
			23	27	37	43	48	52	55	56	
E	$\frac{S_{tr}}{S} 10^{-\frac{R_{tr}}{10}}$		0.00286	0.00114	0.00011	0.00003	0.00001	0.00000	0.00000	0.00000	
F	$10\log(B + C + D + E)$		-25	-29	-34	-41	-48	-52	-56	-58	
	A	Equivalent Absorption Area	$\frac{0.161 V}{RT}$ (Includes RT rise at low frequency)								
			15	15	15	15	15	15	15	15	
G	$10\log(S/A)$		3	3	3	3	3	3	3	3	

 L_{eq} Results

Term	Term Description	Octave Band Centre Frequency								Broadband
		63	125	250	500	1000	2000	4000	8000	
$L_{eq,2}$	Level in the receiver room (includes facade correction K)	43	37	30	30	25	8	-5	-15	44
	A-weighting	-26	-16	-9	-3	0	1	1	-1	
$L_{Aeq,2}$	A-weighted Level in the receiver room	17	21	21	27	25	9	-4	-16	30

BS8233 Calculation of Noise Break-in : Night-time

Project Number: MRL/100/1414.1v1

Description: No. 19 Mill on Road, Gravesend, Kent

Consultant: Matt Lawrence



Term	Term Description	Value
S_f	Facade area (incl. window) (m^2)	12.0
S_{wi}	Area of the windows (m^2)	1.0
S_c	Area of the ceiling (m^2)	16.0
S_{ew}	Area of the external wall (m^2)	11.0
S	Area of facade and roof	28.0
x	Room Dimension x	4.0
y	Room Dimension y	4.0
z	Room Dimension z	3.0
RT	Receiving Room RT	0.5
K	Facade correction	0.0

BS8233 Result 28 dB(A) **L_{Aeq} Result 28 dB(A)**

Term	Term Description	Description	Octave Band Centre Frequency								Broadband
			63	125	250	500	1000	2000	4000	8000	
A	$L_{eq,ff}$	Free-field L_{eq} outside room	Enter the Octave Band L_{eq} Data								66
	$D_{n,e}$	Insulation of the trickle vent	Ignore Trickle Vent								
B	$\frac{A_s}{S} 10^{-\frac{D_{n,e}}{10}}$		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
	R_{wi}	SRI of the window	4:12:6.4 mm Stadip Silence								
	$\frac{S_{wi}}{S} 10^{-\frac{R_{wi}}{10}}$		0.00000	0.00014	0.00023	0.00004	0.00000	0.00000	0.00000	0.00000	
C	R_{ew}	SRI of the external wall	BS8233 Example - Brick and block external wall								
	$\frac{S_{ew}}{S} 10^{-\frac{R_{ew}}{10}}$		0.00000	0.00004	0.00002	0.00001	0.00000	0.00000	0.00000	0.00000	
D	R_{tr}	SRI of roof/ceiling	Tiled/slatted roof, 25mm plasterboard ceiling, 100mm quilt above ceiling								
	$\frac{S_{tr}}{S} 10^{-\frac{R_{tr}}{10}}$		0.00286	0.00114	0.00011	0.00003	0.00001	0.00000	0.00000	0.00000	
E	$10\log(B + C + D + E)$		-25	-29	-34	-41	-48	-52	-56	-58	
F	A	Equivalent Absorption Area	$\frac{0.161 V}{RT}$ (Includes RT rise at low frequency)								
	$10\log(S/A)$		15	15	15	15	15	15	15	15	
G			3	3	3	3	3	3	3	3	

 L_{eq} Results

Term	Term Description	Octave Band Centre Frequency								Broadband
		63	125	250	500	1000	2000	4000	8000	
$L_{eq,2}$	Level in the receiver room (includes facade correction K)	41	35	29	27	22	6	-7	-17	42
	A-weighting	-26	-16	-9	-3	0	1	1	-1	
$L_{Aeq,2}$	A-weighted Level in the receiver room	15	19	20	24	22	7	-6	-18	28