# EVEREST HOUSE, POTTERS BAR

## Planning Appeal - Acoustic Report

Reference: 10224.RP01.EBF.1
Prepared: 15 April 2020
Revision Number: 1

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# Planning Appeal - Acoustic Report

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| Revision | Comment | Date | Prepared By | Approved By |
|---|---|---|---|---|
| 0 | First issue of report | 8 April 2020 | Helen Sheldon | Torben Andersen |
| 1 | Update Following Team Comments | 15 April 2020 | Helen Sheldon | Torben Andersen |
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*Terms of contract:*



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Contents

# 1.0 INTRODUCTION

It is proposed to create new residential dwellings at Everest House in Potters Bar, which is currently an office building. It is understood that this work is to be carried out under Permitted Development. A noise impact assessment has previously been carried out by KR Associates, and queries have been raised by the Environmental Health Department at Welwyn Hatfield Borough Council. This has led to the refusal of the permitted development application on the grounds of noise. As part of the appeal, RBA Acoustics has been appointed to carry out an updated noise assessment.

This report is intended to provide the updated assessment, which includes a review of changes to the proposed internal layout of the development, and to provide an independent second review of the proposed development.

It is understood that the scope of the original assessment was to only assess the noise impact from existing commercial premises on the proposed development, in line with the requirements of permitted development. Therefore, the scope of this assessment matches that.

A brief summary of acoustic terminology is provided in Appendix A.

# 2.0 PREVIOUS WORK

The previous noise impact assessment is detailed in the following KR Associates report:

- Noise Impact Assessment, KR06604, Version 1.0, dated 3 February 2020

This report (referred to in this document at the KRA report) concluded that the worst affected façade of the proposed development could be subject to noise levels of up to $L_{Aeq}$ 73 dB with all the nearby commercial premises operating simultaneously. It was also noted that while it is understood that the commercial/industrial premises in the area do not operate at night, they are not restricted from doing so, and therefore there is the potential for this level to occur at any point during the daytime or night time.

Comments from the Environmental Health Department on this report were received in a Planning Consultation Memo dated 16 March 2020, and the main comments raised were as follows:

> *'There are serious concerns regarding noise from commercial/industrial noise sources, with the report showing a 73dB LAeq external noise level, along with a 49dB internal noise level with windows open. It is unclear how this internal noise level has been calculated or which rooms it refers to, as generally it is accepted that a partially open window provide an attenuation of 10 to 15dB, which would make the internal noise level 58 to 63dB internally. This would have serious impacts on things people take for granted, such as holding a conversation or watching television.'*

These comments were also re-iterated in the officer's report accompanying the decision notice.

# 3.0 BASIS OF ASSESSMENT

## 3.1 External Noise Levels

Due to the tight timescales, and the current restrictions on the operation of various premises due to the COVID-19 pandemic, it has not been possible for RBA Acoustics to undertake independent noise measurements of the existing commercial premises. This assessment therefore relies upon on the noise level data as reported by KRA.

It is understood from the KRA report that it was not possible to undertake direct measurements of the commercial/industrial premises at the time of the original survey. Therefore, the KRA report takes published noise data for similar premises and operations, and predicts by way of a noise model the likely levels which could occur in the worst case scenario.

This assessment is based on the output of the noise model, as listed in Section 4.5.2 of the KRA report. The predicted levels from the noise model are reproduced in Table 1.

Table 1 – Predicted Noise Levels from all Commercial/Industrial Sources

| Location | Sound Level ($L_{eq}$ dB) at Octave Band Centre Frequency (Hz) | | | | | | | Overall ($L_{Aeq}$ dB) |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | |
| South West corner of Everest House | 59 | 62 | 63 | 65 | 66 | 67 | 64 | 73 |

It should be noted that it has been clarified with KRA that these are considered to be façade noise levels (i.e. occur within 1 m from the existing façade). This has been taken into consideration in the calculations used as the basis of this assessment.

Section 4.5.3 of the KRA report states '*For the purposes of calculating the internal noise levels it is considered appropriate to use the combined noise level calculated from the 3D noise map i.e. LAeq,T 73 dB(A) as detailed in the table above.*

Therefore, the above levels have been used as the basis of the assessments presented in this report.

The levels presented on the noise model image in the KRA report have been used by RBA to interpret the external noise levels around the building, as indicated in the mark up of the building in Appendix C. It should be noted that the boundaries between noise levels may need to be adjusted marginally as the design develops.

## 3.2 Façade Elements

It is understood from the KRA report that secondary glazing is proposed, along with mechanical ventilation (MVHR). The performance of the glazing and brick walls have been based on the information within the KRA report, although the spectral data for 63 Hz and 4 kHz have been obtained from RBA databases for similar constructions, as these were not presented within the KRA report.

It is considered that sound break in from a fully ducted MVHR system will be negligible, and no contribution has been allowed for this route. This is because there is no direct opening between the external environment and the living spaces.

The assumed performance of the glazing and brickwork are presented in Table 2.

In addition to this, again in line with the KRA report, the acoustic performance of an open window has been based on the NANR116 paper from Napier University, which detailed the results of a significant research project into the sound transmission via open windows. As per the KRA report, the reduction of a 0.2m$^2$ open window has been assumed.

It should be noted that the performance of the open window is in the form of a $D_{new}$, which is a level difference assuming a small opening, and is treated differently in the calculations of noise ingress to the development.

Table 2 – Assumed Performance of Façade Elements

| Element | Sound Insulation (R/$D_{ne}$ dB) at Octave Band Centre Frequency (Hz) | | | | | | | Overall (dB) |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | |
| Glazing (double glazing plus secondary) | 25 | 28 | 38 | 43 | 50 | 52 | 50 | $R_w$ 47 |
| Brick/Block Façade | 36 | 47 | 49 | 47 | 56 | 66 | 58 | $R_w$ 55 |
| Open Window | 20 | 14 | 14 | 16 | 14 | 17 | 19 | $D_{new}$ 16 |

## 3.3 Room Geometry

The calculations have been based on the room geometry and window sizes indicated on the following drawings:

- EH.09.PR.FP (first and second floors)
- EH.10.PR.FP (basement and ground)

AND

- EH.09.PR.FP (first and second floors) rev A
- EH.10.PR.FP (basement and ground) rev A

# 4.0 CRITERIA

A number of different standards and criteria are discussed in the KRA report. However, the criteria that have been adopted are to meet appropriate internal noise levels as detailed within BS8233. Reference is also made to the ANC Acoustics, Ventilation and Overheating (AVO) guide, which was in draft form at the time of the KRA report, but has since been published in its final form. This assessment is therefore made on the same basis.

## 4.1 BS8233

The BS8233 criteria are summarised below.

- Living Rooms, daytime (07:00 to 23:00) – $L_{Aeq}$ 35 dB
- Dining Rooms, daytime (07:00 to 23:00) – $L_{Aeq}$ 40 dB
- Bedrooms, daytime (07:00 to 23:00) – $L_{Aeq}$ 35 dB and night time (23:00 to 07:00) – $L_{Aeq}$ 30 dB

## 4.2 AVO Guidance

The Acoustics, Ventilation and Overheating Residential Design Guide (AVO guidance) was published by the Association of Noise Consultants in January 2020. It is intended to provide guidance on the conflict between opening windows for ventilation and overheating and the associated increase in internal noise levels that inevitably occurs.

In general, the guidance promotes a two stage approach, of carrying out an initial high level assessment for a proposed residential development site. If the first stage assessment indicates that noise could be an issue, a more detailed second assessment is then required.

At this site, the anticipated noise levels are clearly of a level which would require a detailed (Stage 2) assessment.

The principles of the AVO guidance are as follows:

- There are three conditions to consider – background ventilation, purge ventilation, and overheating
- If open windows are relied upon for background ventilation, appropriate internal noise levels in line with the relevant standards need to be met with open windows.
- If alternative means of background ventilation are provided (as is the case here with the MVHR system), appropriate internal noise levels should be met with closed windows.
- Opening windows for purge ventilation even in high noise areas is not considered problematic, as these are typically infrequent events of short duration (e.g. getting rid of paint fumes).
- Where opening windows are required to control overheating, typically a relaxed internal noise level can be adopted, although this depends on the extent of the overheating issue – what portions of the year overheating is expected to occur, and whether it occurs at night etc.

In the case of the proposed development at Everest House, MVHR is proposed for background ventilation, and as noted above purge ventilation is not considered to be a significant issue. The concern is therefore the potential for residents to rely on opening windows to control overheating.

The AVO guidance suggests that for a Level 2 assessment, when windows are open for overheating, noise levels below $L_{Aeq,16hr}$ 35 dB during the daytime and $L_{Aeq,8hr}$ 30 dB at night would be considered acceptable, in line with BS8233.

It also suggests that levels which are above $L_{Aeq,16hr}$ 50 dB during the daytime and $L_{Aeq,8hr}$ 42 dB at night would be problematic. Anywhere between these two levels is dependent on a number of factors, with increasing risk of disturbance with an increase in noise level. An extract from the AVO guide is included below for completeness.

It should be noted that the AVO guidance relates specifically to transport noise rather than commercial/industrial noise which is being assessed in this case. However, this is considered a reasonable approach in the absence of other guidance on noise levels with open windows for overheating.

**Table 3-3** Guidance for Level 2 assessment of noise from transport noise sources[Note 1] relating to overheating condition

| Internal ambient noise level [Note 2] | | | Examples of Outcomes [Note 5] | |
|---|---|---|---|---|
| $L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6] | $L_{Aeq,8h}$ during 23:00 – 07:00 | Individual noise events during 23:00 – 07:00 [Note 4] | | |
| > 50 dB | > 42 dB | Normally exceeds 65 dB $L_{AF,max}$ | Noise causes a material change in behaviour e.g. having to keep windows closed most of the time | Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area. |
| Increasing noise level | | | Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night | At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods.<br>As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life.<br>At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8] |
| ≤ 35 dB | ≤ 30 dB | Do not normally exceed $L_{AF,max}$ 45 dB more than 10 times a night | Noise can be heard, but does not cause any change in behaviour | Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response[Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life. |

# 5.0 ASSESSMENT

Calculations have been carried out in line with the method detailed in BS8233: 2014. Example calculations are included in Appendix B.

## 5.1 Closed Windows

As MVHR is proposed for these properties, the is no reliance on opening windows for background ventilation. Therefore, the majority of the time windows can remain closed.

When windows are closed, the predicted noise level in the worst affected living room is $L_{Aeq}$ 25 dB (as detailed in the example calculation in Appendix B). This is true for both the original and revised plans. A similar noise level is predicted in the bedrooms on the worst affected bedrooms on the original plans.

In the revised plants, there are also doors which separate the kitchen area, which is on the worst affected façade, from the living area. When these doors are closed, noise levels from commercial premises would be even lower in this living room, at around $L_{Aeq}$ 13 dB.

In the revised plans, there are no bedrooms on the noisiest elevation, and as such the worst affected bedroom would have internal noise levels from the commercial premises of around $L_{Aeq}$ 15 dB.

Therefore, noise from commercial premises would be controlled to levels comfortably within the target criterion when windows are closed.

## 5.2 Open Windows

*Predicted Internal Noise Levels*

The predicted internal noise levels with open windows in the worst-case locations are summarised below.

Original plans:

- Living rooms and bedrooms on West façade $L_{Aeq}$ 60 dB

Revised plans:

- Kitchen on South West Façade $L_{Aeq}$ 60 dB
- Living room on South West Façade (kitchen doors closed) $L_{Aeq}$ 51 dB
- Bedroom on South West Façade $L_{Aeq}$ 40 dB
- Bedroom on South Façade $L_{Aeq}$ 47 dB

The detailed calculations indicate that an overall reduction of noise level of around 13 dB can be expected with an open window. This is in line with expectations, and general rules of thumb, such as those referenced in the Local Authority response to the original submission.

It should be noted that these levels would only occur when windows are open, which may be required in occasion to control overheating. It should also be noted that these levels are based on all commercial/industrial sources operating at full capacity. In practice, this is unlikely to occur, and noise levels are likely to be lower, particularly at night.

*Assessment*

Approximate internal noise levels expected with open windows around the building are presented in Table 3, along with an assessment in line with the AVO guidance.

This Table should be read in conjunction with the marked up plan in Appendix C, and it should be noted that although the plan relates to the first floor, the same principles would apply at all levels of the building.

Table 3 – Indicative Internal Noise Levels and AVO Assessment

| External Noise Level, ref Appendix C ($L_{Aeq}$ dB) | Approx. Internal Noise Level ($L_{Aeq}$ dB) | Comments re AVO Guidance |
|---|---|---|
| 69 to 73 | 56 to 60 | These zones are considered high risk, but the revised layout of the development is such that no habitable rooms are located on this elevation. Kitchens and bathrooms are less sensitive, and doors have been introduced to separate kitchens on this elevation from living space. Therefore this zone need not be considered. |
| 65 to 68 | 52 to 55 | |
| 61 to 64 | 48 to 51 | These zones are relatively high risk, and it is recommended that in due course (post-planning) an assessment be undertaken to determine the extent of any overheating issues. See note 1. |
| 54 to 60 | 41 to 47 | These zones are considered a low to moderate risk, depending on the duration and time period over which overheating is expected to occur. |
| 51 to 53 | 38 to 40 | |
| 45 to 50 | 32 to 37 | These zones are considered a low risk in terms of disturbance, particularly if overheating is less likely to occur during the night. |
| 44 or below | 31 or below | In these zones, there is considered to be little to no risk of disturbance occurring when windows are open. |

Note 1. Consideration will need to be given to measures which reduce the amount of time for which opening windows would be required to control overheating (such as solar control or shading). In the worst case, mechanical cooling could be used to remove the need to open windows in selected areas where noise levels and extent of overheating are highest.

It can be seen from the above table, in combination with the marked up plan in Appendix C, that the majority of the proposed development would be considered either acceptable or low risk in terms of having opening windows to control overheating. Those areas where a moderate to high risk has been identified may also be considered acceptable given that the assessment is based on a worst case assessment of all sources operating simultaneously, and in practice noise levels from the commercial premises may be lower much of the time.

The highest risk areas have been avoided by careful design of the proposed layout, to ensure there are no habitable rooms on the worst affected elevations.

# 6.0 CONCLUSION

A detailed assessment has been carried out of external building fabric for the proposed residential development at Everest House, Potters Bar.

Calculations indicate that the proposed external building fabric will control noise ingress from the nearby commercial/industrial premises under normal conditions, by virtue of the noise mitigation measures proposed for the scheme, including secondary glazing and ventilation via MVHR units.

In addition to this, an assessment of the acoustic implications of opening windows to control overheating has been carried out. The assessment indicates that the majority of the development would not require any special measures and that if windows are opened for controlling overheating this would not be problematic.

In some areas of the development, it is recommended that an assessment is carried out to determine the need to open windows (or the time for which open windows would be required). If such an assessment were to indicate a relatively extended period is required, control measures may need to be adopted. This may consist of solar control to glazing, solar shading, or in the worst-case, mechanical cooling. This would need to be assessed at the detailed design stage.

Design measures have already been adopted, in the form of a change to the proposed layout to avoid habitable rooms being located on the worst-case façade, to eliminate the highest risk areas.

Therefore, it is considered that the scheme is suitable for residential development.

# Appendix A - Acoustic Terminology

| | |
|---|---|
| A-weighting (e.g. dB(A)) | A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people experience. |
| deciBel (dB) | Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level. |
| $D_{n,e}$ | The difference in sound level via a specified small element in a stated frequency band. A higher numerical quantity represents a better performance. |
| $D_{n,e,w}$ | A single number weighted quantity which characterises the airborne sound insulation through a specified small element. A higher numerical quantity represents a better performance. This is commonly used in relation to the sound insulation through trickle vents. |
| $L_{eq}$ | The level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level. |
| $L_{Aeq,T}$ | The A-weighted level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level. |
| $L_{An}$ (e.g. $L_{A10}$, $L_{A90}$) | The sound level exceeded for n% of the time. E.g. $L_{A1}$ is the A-weighted level exceeded for 1% of the time and as such can be used to represent a maximum level. Similarly, $L_{A90}$ is the level exceeded for 90% of the measurement period, and is often used to describe the underlying background noise. |
| $L_{Amax,T}$ | The instantaneous maximum A-weighted sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, e.g. sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the ambient level. |
| Octave band | A frequency band in which the upper limit of the band is twice the frequency of the lower limit. This allows individual frequencies to be grouped together in order to allow analysis across the frequency range. |
| 1/3 Octave band | A frequency band which is one-third of an octave band. |
| $R_w$ | A single number quantity which characterises the airborne sound insulation of a material or building element in a laboratory test. |

# Appendix B – Example Calculations

An example of the calculation carried out based on the BS8233 method is provided below. For clarity, the BS8233 method is based on the following equation:

$$Leq(internal) = Leq(free\ field) + 10\log\left(\frac{Ao}{S}10^{\frac{-Dne}{10}} + \frac{Swi}{S}10^{\frac{-Rwi}{10}} + \frac{Sew}{S}10^{\frac{-Rew}{10}}\right) + 10log\left(\frac{S}{A}\right) + 3$$

| | | |
|---|---|---|
| Where | Leq(internal) | is the internal noise level in the room |
| | Leq(free field) | is the free field external noise level at the façade location |
| | Ao | is the reference absorption area, 10m$^2$ |
| | S | is the area of the façade |
| | Dne | is the sound insulation performance of the open window |
| | Swi | is the area of the closed window |
| | Rw | is the sound insulation performance of the closed window |
| | Sew | is the area of the external wall |
| | Rew | is the sound insulation performance of the external wall |
| | A | is the absorption area in the room |

When calculating each element separately, the above equation can be re-arranged, as follows:

$$Leq(element) = Leq(free\ field) - R(element) + 10log\left(\frac{Selement}{A}\right) + 3$$

And

$$Leq(small\ element) = Leq(free\ field) - Dne(small\ element) + 10log\left(\frac{Ao}{A}\right) + 3$$

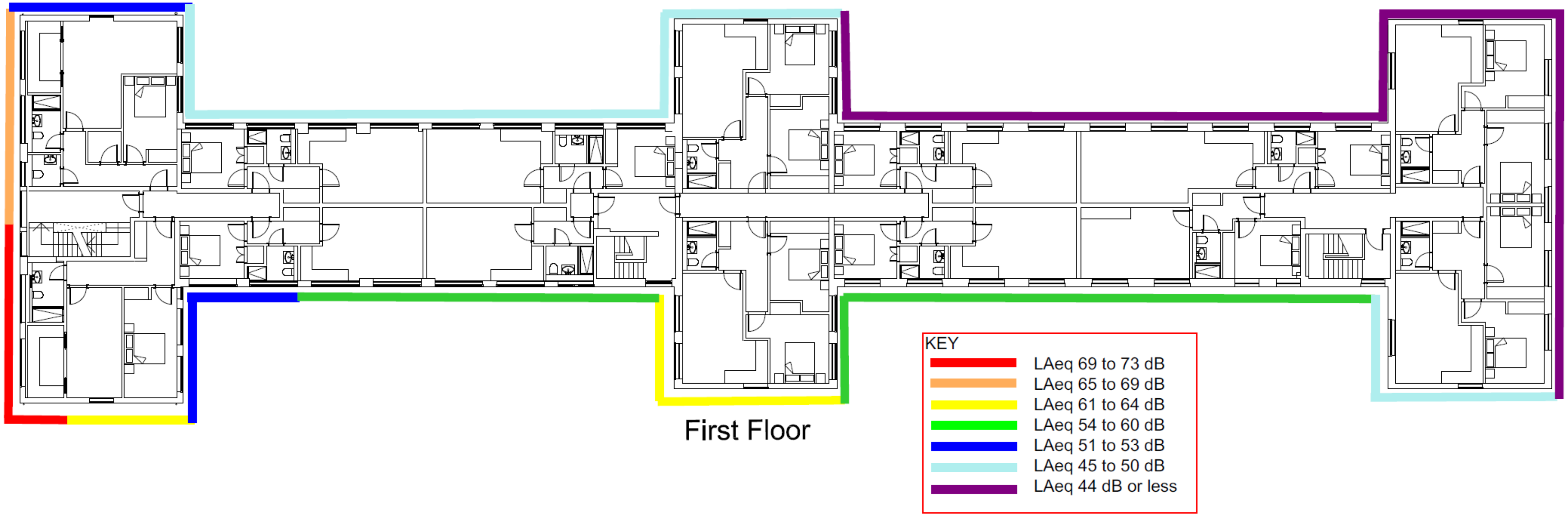
Each individual contribution can then be logarithmically added to calculate the overall internal noise level.

The absorption area within the room has been calculated based on the room geometry, and the assumption that furnished residential premises will have a reverberation time of around 0.5 seconds.

Table B1 – Example Noise Ingress Calculation (BS8233)

| Calculation Step | Octave Band Centre Frequency (Hz) | | | | | | | dB |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | |
| External Façade Level | 59 | 62 | 63 | 65 | 66 | 67 | 64 | 73 |
| External Free Field Level (-3 dB) | 56 | 59 | 60 | 62 | 63 | 64 | 61 | 70 |
| *Break in through brick wall* | | | | | | | | |
| R (brick/block wall) | -36 | -47 | -49 | -47 | -56 | -66 | -58 | $R_w$ 55 |
| 10log(S/A) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Internal Noise Level (wall) | 26 | 18 | 17 | 21 | 13 | 4 | 9 | $L_{Aeq}$ 23 |
| *Break in through closed window* | | | | | | | | |
| R (window) | -25 | -28 | -38 | -43 | -50 | -52 | -50 | $R_w$ 47 |
| 10log(S/A) | -2 | -2 | -2 | -2 | -2 | -2 | -2 | |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Internal Noise Level (window) | 32 | 32 | 23 | 20 | 14 | 13 | 12 | $L_{Aeq}$ 20 |
| **Total Internal Noise Level (windows closed)** | **33** | **32** | **24** | **23** | **16** | **13** | **14** | **$L_{Aeq}$ 25** |
| *Break in through open window* | | | | | | | | |
| Dne (open window) | 20 | 14 | 14 | 16 | 14 | 17 | 19 | $D_{new}$ 16 |
| 10log(Ao/A) | 4 | 4 | 4 | 4 | 4 | 4 | 4 | |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Internal Noise Level (open window) | 43 | 52 | 53 | 53 | 56 | 54 | 49 | $L_{Aeq}$ 60 |
| **Total Internal Noise Level (windows open)** | **44** | **52** | **53** | **53** | **56** | **54** | **49** | **$L_{Aeq}$ 60** |

# Appendix C – Mark-Up of External Noise Levels




Everest House, Potters Bar
Mark Up of External Noise Levels (revised layout)
Project 10224

Figure 1
15 April 2020
Not to Scale

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