PO Box 1030, Warrington, Cheshire WA4 9FJ
t. 01925 723333 www.adcacoustics.co.uk

ARR/PPN/C/1647.08

23rd May 2017

**Carpenter Investments**

Assessment of noise impact at the proposed Education Building and Phase 2 Student Accommodation on the Hardman House and Haigh Building Site, L1 9AS

Prepared for :-

Carpenter Investments
1 Sugnall Street
Liverpool
L7 7EB

Prepared by :-

Andrew Raymond

**CONTENTS**

**1.0 SUMMARY**

**2.0 INTRODUCTION**

**3.0 ASSESSMENT STANDARDS**

3.1 NPPF
3.2 BS8233
3.3 BB93

**4.0 SURVEY DETAILS**

4.1 Site Times and Personnel
4.2 Instrumentation
4.3 Measurement Positions
4.4 Survey Conditions

**5.0 RESULTS AND DISCUSSIONS**

5.1 Basic Results
5.2 Assessment
5.3 Mitigation
5.4 Other Issues

**6.0 CONCLUSIONS/RECOMMENDATIONS**

**Appendix 1: Definition of Acoustic Terms**
**Appendix 2: Measurement and Calculation Details**

## 1.0 SUMMARY

The external noise break-in to the Education Building is low and no mitigation will be required for any of the proposed room uses.

Noise affecting the Phase 2 Student Accommodation comprised traffic on Harman St and what sounded like an extract fan for the Hope and Anchor, as well as voices from pedestrians. Levels on the proposed South Hunter St façade are fairly high and will require mitigation in the form of upgraded glazing to achieve reasonable internal conditions. Basic glazing will be adequate on other facades.

---------- ----------

A R Raymond P J Durell

## 2.0 INTRODUCTION

ADC was asked to carry out an independent assessment of the above site with regards to its suitability for residential development from a noise perspective. It is the second of two assessments, this one covering the proposed Education Building and the extended block of Student Accommodation referred to as Phase 2.

This report begins by summarising assessment standards and, where appropriate, discusses alternative interpretations.

After a brief statement of survey details we discuss basic results and the resulting assessment, along with any mitigation which might be implied. We sum-up and conclude at the end, along with brief recommendations.

## 3.0 ASSESSMENT STANDARDS

### 3.1 NPPF

The National Planning Policy Framework provides nothing in the way of quantitative criteria. The main statement on noise is to be found in paragraph 123:-

123. 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 create 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.

The NPPF refers to the Noise Policy Statement for England (NPSE) which sets out the following aims:-

1. avoid significant adverse impacts on health and quality of life;
2. mitigate and minimise adverse impacts on health and quality of life; and
3. where possible, contribute to the improvement of health and quality of life.

It also introduces the concepts of:

- NOEL – No Observed Effect Level. 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. This is the level above which significant adverse effects on health and quality of life occur.

SOAEL is clearly something the policy seeks to avoid in aim 1. Aim 2 represents situations between SOAEL and LOAEL, and seeks to minimise and mitigate the effects.

## 3.2 BS8233

BS8233 was updated in March 2014. Quantitatively, however, the design criteria are little changed – just expressed differently to reduce ambiguity in certain situations.

Table 4 of BS8233 gives the desirable criteria for indoor ambient noise levels for dwellings as follows:-

| 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 $L_{Aeq,16hour}$ |

Note that the standard accepts the widely used rule of thumb that, for a partly open window, the levels just outside will be 15dB higher than those just inside. This brings us to an external equivalent of the above table, as follows:-

| Activity | Location | 07:00 to 23:00 | 23:00 to 07:00 |
|---|---|---|---|
| Resting | Living room | 50 dB $L_{Aeq,16hour}$ | - |
| Dining | Dining room/area | 55 dB $L_{Aeq,16hour}$ | - |
| Sleeping (daytime resting) | Bedroom | 50 dB $L_{Aeq,16hour}$ | 45 dB $L_{Aeq,16hour}$ |

It goes on to state that, where necessary, the criteria can be relaxed by up to 5 dB and still achieve reasonable conditions. Note that the new version no longer states criteria for bedroom noise in terms of dB $L_{Amax}$.

Garden area criteria are unchanged with 50 dB $L_{Aeq}$ and 55 dB $L_{Aeq}$ being considered desirable and reasonable respectively.

Note that the new version of BS8233 more explicitly specifies the assessment periods as 16 hour and 8 hour for daytime and night time respectively.

## 3.3 BB93

BB93 is the main document for acoustic and noise assessment for education establishments. Table 1 shows a list of room uses, their noise generation and sensitivity which does not concern us here, and the ambient internal noise levels. The table is reproduced below and it is the column second from the right which shows the criteria.

**Table 1: noise activity and sensitivity levels and upper limits for indoor ambient noise level**

| Type of room | Room classification for the purpose of airborne sound insulation in Tables 3a and 3b | | Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB | |
|---|---|---|---|---|
| | Activity noise (Source room) | Noise tolerance (Receiving room) | New build | Refurbishment |
| Nursery school rooms<br>*Primary school:* classroom, class base, general teaching area, small group room<br>*Secondary school:* classroom, general teaching area, seminar room, tutorial room, language laboratory | Average | Medium | 35 | 40 |
| *Open plan: (See also section 1.8)*<br>Teaching area<br>Resource/breakout area | Average | Medium | 40 | 45 |
| Primary music room | High | Medium | 35 | 40 |
| Secondary music classroom[1]<br>Small and large practice/group room[1]<br>Performance/recital room[1] | Very high | Low | 35 | 40 |
| Performance/recital room[1]<br>Ensemble room [1]<br>Recording studio[1] | Very high | Low | 30 | 35 |
| Control room - for recording[1]<br>Control room - not for recording | High Average | Low Medium | 35 | 40 |
| Lecture room | Average | Medium | 35 | 40 |
| Teaching space intended specifically for students with special hearing and communication needs[2] | Average | Low | 30 | 35 |
| SEN calming room | High | Low | 35 | 35 |

| Type of room | Room classification for the purpose of airborne sound insulation in Tables 3a and 3b | | Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB | |
|---|---|---|---|---|
| | Activity noise (Source room) | Noise tolerance (Receiving room) | New build | Refurbishment |
| Study room (individual study, withdrawal, remedial work, teacher preparation) | Low | Medium | 40 | 45 |
| *Libraries:* | | | | |
| Quiet study area | Low | Medium | 40 | 45 |
| Resource area | Average | Medium | 40 | 45 |
| Science laboratory | Average | Medium | 40 | 45 |
| *Design and technology:* | | | | |
| Resistant materials, CADCAM area | High | High | 40 | 45 |
| Electronics/control, textiles, food, graphics, design/resource area, ICT room, art | Average | Medium | 40 | 45 |
| Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music) | High | Low | 35 | 40 |
| Atrium, circulation space not intended for teaching and learning | Average | Medium | 45 | 50 |
| Sports hall<br>Dance studio<br>Gymnasium/Activity studio | High | Medium | 40 | 45 |
| Swimming pool | High | High | 50 | 55 |
| Meeting room, Interviewing/counselling room, video conference room | Low | Medium | 40 | 45 |
| Dining room | High | High | 45 | 50 |

| Type of room | Room classification for the purpose of airborne sound insulation in Tables 3a and 3b | | Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB | |
|---|---|---|---|---|
| | Activity noise (Source room) | Noise tolerance (Receiving room) | New build | Refurbishment |
| *Administration and ancillary spaces:* | | | | |
| Kitchen | High | High | 50 | 55 |
| Office, medical room, staff room | Low | Medium | 40 | 45 |
| Corridor, stairwell, coats and locker area | Average | High | 45 | 55 |
| Changing area | High | High | 50 | 55 |
| Toilet | Average | High | 50 | 55 |

## 4.0 SURVEY DETAILS

### 4.1 Site Times and Personnel

The measurements were carried out by Andrew Raymond of ADC Acoustics.

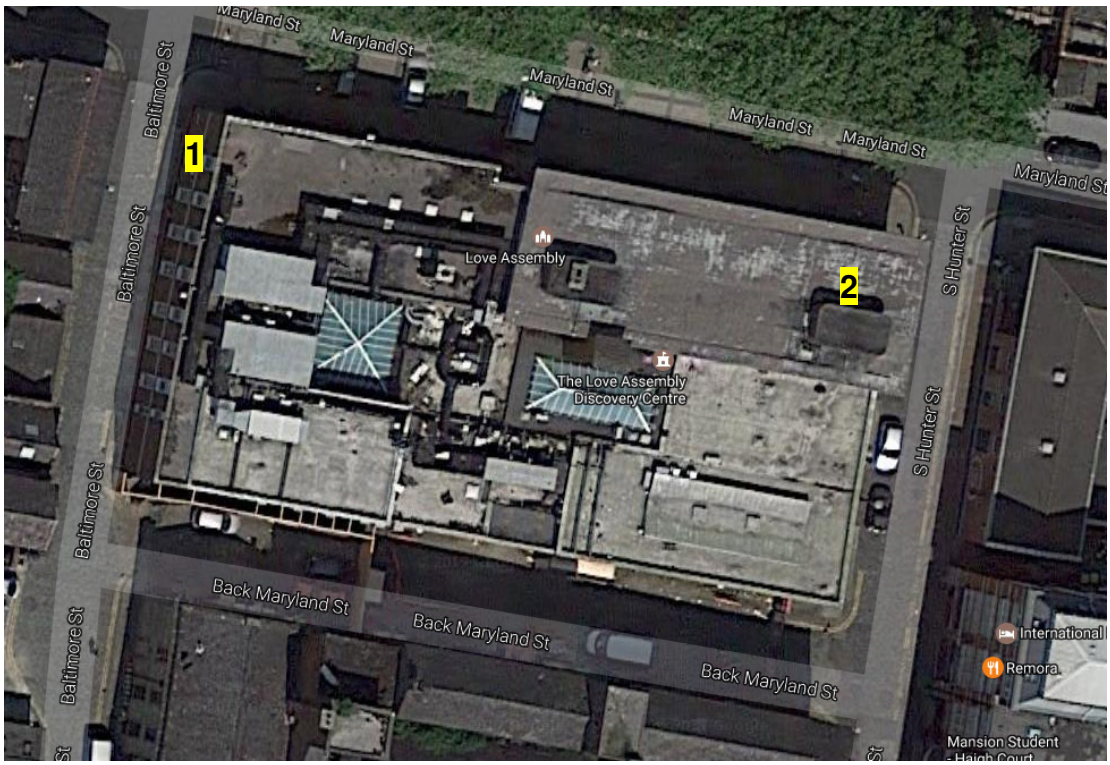
Measurements in what will be the Education Building was carried out from shortly before 16:00 to shortly before 17:00 on Friday 5th May 2017. Measurements on the South Hunter St façade (proposed Student Accommodation) were carried out from approximately17:00 on Friday 5th May through to approximately 11:30 the following morning.

### 4.2 Instrumentation

Instrumentation used was a Rion NL52. This is a precision grade sound level meter which holds a current calibration certificate and which was field-calibrated as necessary. The meter was set up to measure continuous 5 minute samples the proposed Education Building location and continuous 15 minute samples in the proposed Student Accommodation location. All measurements were in terms of dB $L_{eq}$, dB $L_{max}$ and dB $L_{90}$ in overall A-weighted terms, and in octave bands across the frequency range. See Definition of Acoustic Terms in Appendix 1.

### 4.3 Measurement Positions

As the existing buildings are to be demolished and replaced by entirely different buildings, options for representative measurement positions were limited. The following plan shows the approxiamte positions.




Position 1 was centrally within the Carpenter Projects office on the first floor with three windows overlooking Maryland St and one window overlooking Baltimore St and represents the proposed Education Building.

For Positions 2 the microphone was on a boom outside the stairwell window near the corner of the building on South Hunter St and represents a worst case for the proposed Phase 2 Student Accommodation.

4.4 Survey Conditions

We have no reason to believe that the conditions we found on the survey were anything other than representative of normal conditions. A Friday afternoon/night was chosen to represent a probable worst case.

Weather conditions were as follows :-

| | | |
|---|---|---|
| Rain | : | None, dry roads |
| Cloud | : | 0 to 50% |
| Temperature | : | 8 to 15 Celsius |
| Wind | : | up to 5m/s |

## 5.0 RESULTS AND DISCUSSIONS

Noise affecting the Education Building part of the site was low level and mainly local traffic and pedestrians and general distant noise from the city.

Noise affecting the Phase 2 Student accommodation was dominated by traffic on Harman St and what sounded like an extract fan for the Hope and Anchor, as well as voices from pedestrians.

5.1 Basic Results

Full details are given in Appendix 2. A summary is as follows:-

| *Summary Position 1* | Index | **dB(A)** |
|---|---|---|
| Internal Windows Open | Leq | **40** |
| | Lmax | **51** |
| | L90 | **37** |
| Internal Windows Closed | Leq | **32** |
| | Lmax | **45** |
| | L90 | **28** |

| *Summary Position 2* | Index | **dB(A)** |
|---|---|---|
| Friday Rush Hour | Leq | **60** |
| | Lmax | **80** |
| | L90 | **58** |
| Friday Evening | Leq | **60** |
| | Lmax | **80** |
| | L90 | **58** |
| Friday Night | Leq | **60** |
| | Lmax | **74** |
| | L90 | **56** |

## 5.2 Assessments

The above results give the following assessments.

### Education Building

Note that these measurements were *internal*. Although the building will be demolished and replaced the measurements should be representative of a worst case in that:-

- The room was uncarpeted and sparsely furnished (an office).
- It was a corner room and so had two external facades.
- There were 4 large single glazed windows (each estimated to be 1m wide and 1.8m high). One windows overlooked Maryland St and three overlooked Baltimore St.
- Test were done with windows open as well as closed (although one of the three windows on Baltimore St could not be opened).

Proposed room uses and associated BB93 criteria are as follows:-

- Teaching Rooms 35 dB $L_{Aeq}$
- Lecture Theatre 35 dB $L_{Aeq}$
- Staff Rooms 40 dB $L_{Aeq}$
- Offices 40 dB $L_{Aeq}$
- Breakout 40 dB $L_{Aeq}$
- Collaborative 40 dB $L_{Aeq}$

The teaching rooms and lecture theatre will need to rely on closed to meet criteria windows but any grade of glazing and non-acoustic vent will be more than adequate. Other uses presumably will be ventilated but can in any case rely on open windows and still meet criteria.

Student Accommodation

In terms of BS8233, we are mainly concerned with the dB(A) $L_{eq}$ values, or the dB $L_{Aeq}$ levels. See definition of Acoustic Terms in Appendix 1. The new version of BS8233 no longer has night time criteria in terms of dB(A) $L_{max}$ values, or dB $L_{Amax}$ values, but some local authorities still like to see them presented.

The measured levels appear to suggest that sound insulation will need to be designed to control external noise break-in as follows:

| Environment | Position | Required Reductions | |
|---|---|---|---|
| | | Desirable | Reasonable |
| Living Rooms | Main | 25 dB | 20 dB |
| Bedrooms | Main | 25 dB | 20 dB |

Note that these required reductions are for the South Hunter St façade. Other facades can be expected to be at least 5 dB less, an much more on the inner facing facades.

They are also based on a Friday afternoon and night so should represent a worst case.

5.3 Mitigation

A partly open window can be expected to provide about 15 dB reduction. This will not be sufficient to achieve BS8233 criteria. However a whole-house-type scheme of ventilation is proposed, making closed windows a reasonable choice for occupants.

So, based on closed windows, a summary of mitigation (or building elements assumed in our calculations) is as follows:-

| Façade | Room Type | Make-Up on Which Calculations are Based |
|---|---|---|
| S Hunter St | Living Room | Walls: Traditional Masonry<br>Glazing: 35 dB Rw, eg. 10+14+6<br>Vents: None - Whole House System |
| | Bedroom | Walls: Traditional Masonry<br>Glazing: 35 dB Rw, eg. 10+14+6<br>Vents: None - Whole House System |
| Other Facades | Living Room | Walls: Traditional Masonry<br>Glazing: Basic thermal eg. 4+20+4<br>Vents: None - Whole House System |
| | Bedroom | Walls: Traditional Masonry<br>Glazing: Basic thermal eg. 4+20+4<br>Vents: None - Whole House System |

In summary, all habitable rooms overlooking South Hunter St will require fairly high spec glazing (35 dB $R_w$). All other facades should be fine with basic thermal double glazing. Ventilation is provided by a whole-house-type mechanical system.

Full calculation details are shown in Appendix 2 and a summary of predicted internal levels is as follows:-

| Façade | Time | Index | **dB(A)** |
|---|---|---|---|
| S Hunter St | Rush | Leq | **32** |
| | Night | Leq | **32** |
| | | Lmax | **44** |
| Other Facades | Rush | Leq | **34** |
| | Night | Leq | **33** |
| | | Lmax | **44** |

5.4 Other Issues

Although it is not part of the scope for this assessment, we feel it is important to discuss briefly the commercial units. Clearly it is impossible carry out a detailed assessment as the exact uses are not yet known and may in any case change over time.

You will be obliged to comply with the sound insulation criteria of the Building Regulations Part E, and this will be enforced by Building Control not Planning. We also recommend that you put the onus on future tenants and occupiers of the commercial units to ensure that their activities do not exceed appropriate criteria, such as BS8233 for general activities, inaudibility for music, etc. Planners may seek to impose a condition requiring you to submit for approval a tenants' requirements document.

The commercial units may well wish to fit mechanical equipment such as external refrigeration equipment. Exact details cannot be known at this stage but a condition requiring proposals to be submitted for approval would be a straight forwards solution.

## 6.0 CONCLUSIONS/RECOMMENDATIONS

The external noise break-in to the Education Building is low and no mitigation will be required for any of the proposed room uses.

Noise affecting the Phase 2 Student Accommodation comprised traffic on Harman St and what sounded like an extract fan for the Hope and Anchor, as well as voices from pedestrians. Levels on the proposed South Hunter St façade are fairly high and will require mitigation in the form of upgraded glazing to achieve reasonable internal conditions. More basic glazing will be adequate on other facades.

Inward facing facades should be fine with no particular mitigation measures.

The commercial units are not part of the scope of this report but can easily be controlled by conditions. A short statement should be adequate.

## Appendix 1

## Definition of Acoustic Terms

The Decibel

The decibel is the basic unit of noise measurement and is denoted dB. Technically, it is a means of expressing the difference in noise level between the measured noise and a standard level of noise. Most often the threshold of human hearing is used as the standard reference but is really should be stated. The threshold of human hearing is a sound pressure of 20μPa or a sound power of 1pW.

A sound pressure level or SPL should be expressed in dB(re. 20μPa). A sound power level or SWL should be expressed in dB(re. 1pW). If the reference levels are omitted, it will often (but not always) be safe to assume that they are referenced to the threshold of human hearing.

A-Weighting and dB(A)

The human hearing system responds differently to different frequencies. The A-weighting system takes account of this by emphasising mid and high frequencies more than low frequencies to given an overall level. An A-Weighted noise level, therefore, reflects the way normal, healthy hearing would perceive the overall level of the noise. The basic unit is dB(A), although other systems of expressing an A-weighted level are discussed below.

Other weighting systems, such as C-Weighting, denoted dB(C), reflect the human hearing system's response at higher noise levels.

Equivalent Continuous Sound Level, $L_{eq}$

This is a kind of mean noise level.

The unit is dB $L_{eq}$. For A-weighted levels the unit is dB(A) $L_{eq}$ or, in more modern units, dB $L_{Aeq}$. The Noise at Work Regulations use $L_{eq(s)}$ which refers to a sample level.

Maximum Level, $L_{max}$

This is the maximum level reached (usually for a fraction of a second) in the measurement period.

The unit is dB $L_{max}$. For A-weighted levels the unit is dB(A) $L_{max}$ or, in more modern units, dB $L_{Amax}$.

Statistical (Percentile) Levels, $L_n$

During a measurement of fluctuating noise, it is often useful to establish the levels exceed for a percentage of the time. $L_n$ is the index representing the level exceeded for n% of the measurement period.

The unit is dB $L_n$. For A-weighted levels, the unit is dB(A) $L_n$ or, in more modern units, dB $L_{An}$.

Common examples are as follows :-

dB $L_{A90}$ is the A-weighted level exceeded for 90% of the time and is often used to describe the underlying background noise.

dB $L_{A50}$ is the A-weighted level exceed for 50% of the time. Mathematically, it is the median, another kind of average.

dB $L_{A10}$ is the A-weighted level exceeded for 10% of the time and has traditionally been used to describe the intermittent highs in the noise climate such as passing cars or aircraft.

Frequency Analysis

Here the audible frequency range is divided up into bands and the noise level is expressed in each frequency band form low pitches to high pitches.

Octave Band analysis is where the frequency range is divided into 8 bands from 63 Hz to 8kHz, or sometimes into 10 bands from 31.5 Hz to 16kHz.

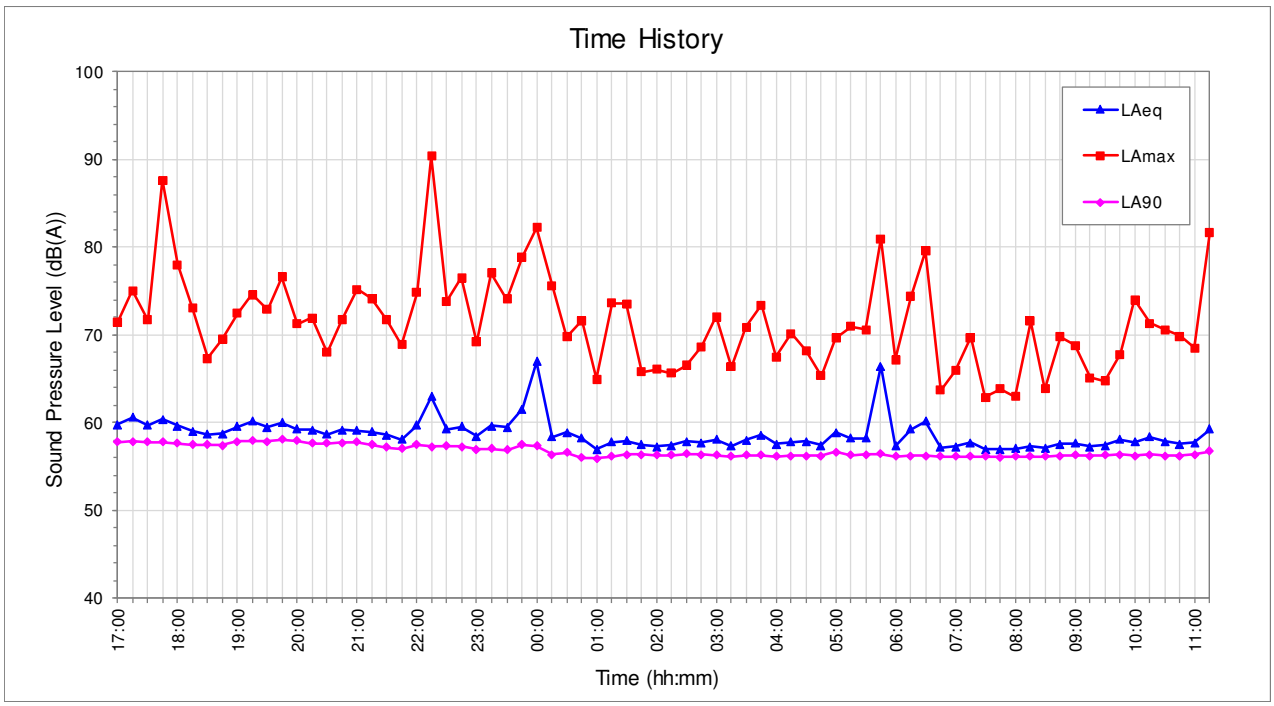
1/3 Octave Band analysis provides more detailed subdivision into 24 bands from 50 Hz to 10kHz, or sometimes into 30 bands from 20Hz to 20kHz.

Narrow Band analysis takes this further with the possibility of many thousands of bands, possibly only 1Hz wide, or even less.

In all types of frequency analysis, the level in each band can be expressed in terms of $L_{eq}$, $L_{max}$, $L_n$, etc. as defined above.

# Appendix 2

## Measurement and Calculation Details




Measurement Summary

| *Summary Position 1* | Index | **dB(A)** | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal Windows Open | Leq | **40** | 51 | 42 | 39 | 36 | 36 | 31 | 23 | 17 |
| | Lmax | **51** | 60 | 50 | 44 | 48 | 47 | 45 | 37 | 29 |
| | L90 | **37** | 47 | 39 | 37 | 34 | 32 | 27 | 19 | 15 |
| Internal Windows Closed | Leq | **32** | 48 | 37 | 32 | 26 | 25 | 25 | 22 | 17 |
| | Lmax | **45** | 60 | 46 | 40 | 38 | 36 | 39 | 39 | 30 |
| | L90 | **28** | 42 | 34 | 29 | 23 | 20 | 21 | 15 | 15 |

| *Summary Position 2* | Index | **dB(A)** | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
|---|---|---|---|---|---|---|---|---|---|---|
| Friday Rush Hour | Leq | **60** | 67 | 67 | 64 | 55 | 52 | 49 | 42 | 34 |
| | Lmax | **80** | 85 | 76 | 73 | 76 | 73 | 74 | 69 | 65 |
| | L90 | **58** | 63 | 67 | 63 | 52 | 48 | 43 | 36 | 24 |
| Friday Evening | Leq | **60** | 67 | 67 | 63 | 55 | 53 | 49 | 41 | 35 |
| | Lmax | **80** | 85 | 77 | 71 | 73 | 73 | 75 | 68 | 65 |
| | L90 | **58** | 63 | 67 | 63 | 52 | 48 | 43 | 36 | 24 |
| Friday Night | Leq | **60** | 65 | 68 | 63 | 55 | 53 | 49 | 43 | 36 |
| | Lmax | **74** | 82 | 76 | 72 | 71 | 69 | 67 | 60 | 55 |
| | L90 | **56** | 62 | 67 | 62 | 48 | 43 | 39 | 33 | 23 |

Required Reductions fro BS8233 Guidelines

| Environment | Position | Required Reductions | |
|---|---|---|---|
| | | Desirable | Reasonable |
| Living Rooms | Main | 25 dB | 20 dB |
| Bedrooms | Main | 25 dB | 20 dB |

Mitigation Summary

| Façade | Room Type | Make-Up on Which Calculations are Based |
|---|---|---|
| S Hunter St | Living Room | Walls: Traditional Masonry<br>Glazing: 35 dB Rw, eg. 10+14+6<br>Vents: None - Whole House System |
| | Bedroom | Walls: Traditional Masonry<br>Glazing: 35 dB Rw, eg. 10+14+6<br>Vents: None - Whole House System |
| Other Facades | Living Room | Walls: Traditional Masonry<br>Glazing: Basic thermal eg. 4+20+4<br>Vents: None - Whole House System |
| | Bedroom | Walls: Traditional Masonry<br>Glazing: Basic thermal eg. 4+20+4<br>Vents: None - Whole House System |

Predicted Summary

| Façade | Time | Index | **dB(A)** | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S Hunter St | Rush | Leq | **32** | 49 | 44 | 37 | 23 | 15 | 12 | -2 | -9 |
| | Night | Leq | **32** | 48 | 45 | 36 | 23 | 16 | 12 | -1 | -8 |
| | | Lmax | **44** | 65 | 54 | 45 | 38 | 33 | 30 | 16 | 11 |
| Other Facades | Rush | Leq | **34** | 47 | 42 | 41 | 25 | 12 | 7 | 6 | -2 |
| | Night | Leq | **33** | 46 | 43 | 40 | 24 | 13 | 7 | 6 | -1 |
| | | Lmax | **44** | 63 | 51 | 49 | 39 | 29 | 25 | 23 | 18 |

Break-in

| *S Hunter St*<br>*Living Room* | | | ***dB(A)*** | *63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Width of Exposed Façade 1 | 3.30 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 2 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 3 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 4 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Total Exposed Façade Width | 3.30 m | | **-** | - | - | - | - | - | - | - | - |
| Element Height | 2.50 m | | **-** | - | - | - | - | - | - | - | - |
| Room Depth (re. Exposed façade 1) | 6.50 m | | | | | | | | | | |
| Element Area | 8.25 m2 | | **-** | - | - | - | - | - | - | - | - |
| Effective Area (ie. with vents) | 8.25 m2 | | **-** | - | - | - | - | - | - | - | - |
| Room Volume | 53.63 m3 | | **-** | - | - | - | - | - | - | - | - |
| Assumed RT | 0.50 s | | **-** | - | - | - | - | - | - | - | - |
| Element Area Correction | | | **-** | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Room Correction 10 x Log (RT/0.163/V) | | | **-** | -12 | -12 | -12 | -12 | -12 | -12 | -12 | -12 |
| Walls: Traditional Masonry | 4.95 m2 | | **-** | 26 | 32 | 41 | 47 | 49 | 53 | 58 | 55 |
| Glazing: 35 dB Rw, eg. 10+14+6 | 3.30 m2 | | **-** | 18 | 24 | 27 | 32 | 37 | 37 | 44 | 44 |
| Vents: None - Whole House System | 0.00 m2 | | **-** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Composite SRI | 8.25 m2 | | **-** | 21 | 27 | 31 | 36 | 41 | 41 | 48 | 47 |
| Level Difference (Reverberant only) | | | **-** | -24 | -30 | -34 | -39 | -44 | -44 | -51 | -51 |
| Allowance for flanking/workmanship | 7 dB | | **-** | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Predicted Internal Levels | Rush | Leq | **32** | 49 | 44 | 37 | 23 | 15 | 12 | -2 | -9 |
| | Evening | Leq | **32** | 49 | 44 | 36 | 23 | 16 | 12 | -2 | -9 |
| | Night | Leq | **32** | 48 | 45 | 36 | 23 | 16 | 12 | -1 | -8 |
| | | Lmax | **43** | 64 | 53 | 45 | 38 | 33 | 30 | 16 | 11 |

| *Other Facades*<br>*Living Room* | | | ***dB(A)*** | *63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Width of Exposed Façade 1 | 3.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 2 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 3 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 4 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Total Exposed Façade Width | 3.00 m | | **-** | - | - | - | - | - | - | - | - |
| Element Height | 3.00 m | | **-** | - | - | - | - | - | - | - | - |
| Room Depth (re. Exposed façade 1) | 5.00 m | | | | | | | | | | |
| Element Area | 9.00 m2 | | **-** | - | - | - | - | - | - | - | - |
| Effective Area (ie. with vents) | 9.00 m2 | | **-** | - | - | - | - | - | - | - | - |
| Room Volume | 45.00 m3 | | **-** | - | - | - | - | - | - | - | - |
| Assumed RT | 0.50 s | | **-** | - | - | - | - | - | - | - | - |
| Element Area Correction | | | **-** | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Room Correction 10 x Log (RT/0.163/V) | | | **-** | -12 | -12 | -12 | -12 | -12 | -12 | -12 | -12 |
| Walls: Traditional Masonry | 6.24 m2 | | **-** | 26 | 32 | 41 | 47 | 49 | 53 | 58 | 55 |
| Glazing: Basic thermal eg. 4+20+4 | 2.76 m2 | | **-** | 15 | 21 | 17 | 25 | 35 | 37 | 31 | 31 |
| Vents: None - Whole House System | 0.00 m2 | | **-** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Composite SRI | 9.00 m2 | | **-** | 19 | 25 | 22 | 30 | 40 | 42 | 36 | 36 |
| Level Difference (Reverberant only) | | | **-** | -22 | -28 | -24 | -32 | -42 | -44 | -38 | -38 |
| Allowance for flanking/workmanship | 7 dB | | **-** | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Predicted Internal Levels | Rush | Leq | **34** | 47 | 42 | 41 | 25 | 12 | 7 | 6 | -2 |
| | Evening | Leq | **34** | 47 | 42 | 41 | 25 | 13 | 7 | 5 | -1 |
| | Night | Leq | **34** | 45 | 42 | 41 | 25 | 13 | 7 | 7 | -1 |
| | | Lmax | **44** | 62 | 51 | 50 | 40 | 29 | 25 | 24 | 19 |

| *S Hunter St*<br>*Bedroom* | | | **dB(A)** | *63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Width of Exposed Façade 1 | 2.80 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 2 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 3 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 4 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Total Exposed Façade Width | 2.80 m | | **-** | - | - | - | - | - | - | - | - |
| Element Height | 2.50 m | | **-** | - | - | - | - | - | - | - | - |
| Room Depth (re. Exposed façade 1) | 3.50 m | | | | | | | | | | |
| Element Area | 7.00 m2 | | **-** | - | - | - | - | - | - | - | - |
| Effective Area (ie. with vents) | 7.00 m2 | | **-** | - | - | - | - | - | - | - | - |
| Room Volume | 24.50 m3 | | **-** | - | - | - | - | - | - | - | - |
| Assumed RT | 0.50 s | | **-** | - | - | - | - | - | - | - | - |
| Element Area Correction | | | **-** | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Room Correction 10 x Log (RT/0.163/V) | | | **-** | -9 | -9 | -9 | -9 | -9 | -9 | -9 | -9 |
| Walls: Traditional Masonry | 5.65 m2 | | **-** | 26 | 32 | 41 | 47 | 49 | 53 | 58 | 55 |
| Glazing: 35 dB Rw, eg. 10+14+6 | 1.35 m2 | | **-** | 18 | 24 | 27 | 32 | 37 | 37 | 44 | 44 |
| Vents: None - Whole House System | 0.00 m2 | | **-** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Composite SRI | 7.00 m2 | | **-** | 23 | 29 | 33 | 39 | 43 | 44 | 50 | 50 |
| Level Difference (Reverberant only) | | | **-** | -24 | -30 | -34 | -39 | -44 | -44 | -51 | -50 |
| Allowance for flanking/workmanship | 7 dB | | **-** | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Predicted Internal Levels | Rush | Leq | **32** | 50 | 45 | 37 | 23 | 16 | 11 | -2 | -9 |
| | Evening | Leq | **32** | 50 | 45 | 36 | 23 | 16 | 12 | -3 | -8 |
| | Night | Leq | **32** | 48 | 45 | 36 | 23 | 16 | 12 | -1 | -8 |
| | | Lmax | **44** | 65 | 54 | 45 | 38 | 33 | 30 | 16 | 11 |

| *Other Facades*<br>*Bedroom* | | | **dB(A)** | *63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Width of Exposed Façade 1 | 4.50 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 2 | 5.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 3 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Width of Exposed Façade 4 | 0.00 m | | **-** | - | - | - | - | - | - | - | - |
| Total Exposed Façade Width | 9.50 m | | **-** | - | - | - | - | - | - | - | - |
| Element Height | 2.50 m | | **-** | - | - | - | - | - | - | - | - |
| Room Depth (re. Exposed façade 1) | 5.00 m | | | | | | | | | | |
| Element Area | 23.75 m2 | | **-** | - | - | - | - | - | - | - | - |
| Effective Area (ie. with vents) | 23.75 m2 | | **-** | - | - | - | - | - | - | - | - |
| Room Volume | 56.25 m3 | | **-** | - | - | - | - | - | - | - | - |
| Assumed RT | 0.50 s | | **-** | - | - | - | - | - | - | - | - |
| Element Area Correction | | | **-** | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Room Correction 10 x Log (RT/0.163/V) | | | **-** | -13 | -13 | -13 | -13 | -13 | -13 | -13 | -13 |
| Walls: Traditional Masonry | 20.99 m2 | | **-** | 26 | 32 | 41 | 47 | 49 | 53 | 58 | 55 |
| Glazing: Basic thermal eg. 4+20+4 | 2.76 m2 | | **-** | 15 | 21 | 17 | 25 | 35 | 37 | 31 | 31 |
| Vents: None - Whole House System | 0.00 m2 | | **-** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Composite SRI | 23.75 m2 | | **-** | 22 | 28 | 26 | 34 | 43 | 46 | 40 | 40 |
| Level Difference (Reverberant only) | | | **-** | -21 | -27 | -25 | -33 | -42 | -44 | -39 | -39 |
| Allowance for flanking/workmanship | 7 dB | | **-** | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Predicted Internal Levels | Rush | Leq | **34** | 48 | 42 | 40 | 24 | 12 | 6 | 5 | -3 |
| | Evening | Leq | **33** | 47 | 42 | 40 | 24 | 13 | 7 | 4 | -2 |
| | Night | Leq | **33** | 46 | 43 | 40 | 24 | 13 | 7 | 6 | -1 |
| | | Lmax | **44** | 63 | 51 | 49 | 39 | 29 | 25 | 23 | 18 |