



CONDITION 10 DISCHARGE NOISE ASSESSMENT

# LAND ADJACENT 114- 116 SCHOOL ROAD, TILEHURST, READING RG31 5AX

CHESTERS PLACE LIMITED

JUNE 2022

**CONDITION 10 DISCHARGE NOISE ASSESSMENT  
LAND ADJACENT 114-116 SCHOOL ROAD,  
TILEHURST, READING RG31 5AX**

Our Ref: 5945\_001R\_1-0\_CW.DOCX



**Client:** Chesters Place Limited

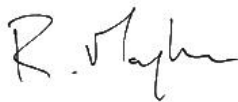
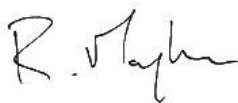
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## REVISION HISTORY

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## EXECUTIVE SUMMARY

The construction of a building to provide ground floor retail unit with 4 no. residential flats above on land adjacent 114-116 School Road, Tilehurst, Reading RG31 5AX has been granted planning permission (ref. 220086), subject to a number of conditions.

This report concerns **Condition 10**, which requires a scheme demonstrating that the internal sound levels will conform to the requirements of **BS 8233** is submitted to Reading Borough Council for approval. The full wording of the condition is given in **Section 1**.



This report presents the scheme, such as is required, with the details summarised below. It is based on a combination a week-long noise survey on the site, the drawings of the development, details of the glazing units and ventilation systems and other construction elements to be adopted, and the calculation procedure in **BS 8233**.

The noise survey, undertaken at the end of **May 2022**, determined that levels representative of those to be experienced at the front of the flats overlooking School Road were consistently around 66 dB (L<sub>Aeq,16h</sub>) during the day and 59 dB (L<sub>Aeq,8h</sub>) at night. At the side, levels were found to be around 8 dB lower.

The condition includes the requirement that, “Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation.”

This is arguably a very stringent approach, and where we feel a 10 dBA threshold would be more in keeping with relevant guidance.

As it is, with windows open, and based on the assumption of a resultant sound insulation performance of 15 dBA, the internal levels in the majority of instances will exceed the **BS 8233** criteria by more than 5 dBA, whereby the applicant has accepted the requirement for MVHR units (in all flats). The units will include boost and “summer bypass” settings to aid cooling/avoid unwanted heating, and will meet the same **BS 8233** internal criteria during normal operation. They will also be installed to adequately control break-in noise via the wall-mounted vents.

This means that no trickle (background) ventilation units will be required, whereby the façade sound insulation performance is dictated by the windows, with units being selected in order to meet the **BS 8233** criteria, as detailed in **Table 5.3** (i.e. a combination of the Duraflex 70mm Diamond suite single casement windows of make up: 4 / 18 / 6; 4 / 18 / 6.8; and 6 / 16 / 8.8). The windows will be openable at the occupants’ discretion.

It is considered, therefore, that the details presented in this report are sufficient to discharge **Condition 10**.

## 1 INTRODUCTION

Anderson Acoustics Ltd was commissioned by Chesters Place Limited to undertake a noise assessment to support the discharge of **Condition 10** within the Decision Notice for application ref. 220086. The site address and development description as per the Decision Notice are:

Land Adjacent 114-116 School Road Tilehurst Reading RG31 5AX.

Erection of building to provide ground floor retail unit with 4 no. residential flats above.

The land being current vacant save for an advertising billboard.

**Condition 10** is as follows:

10. **[Pre-commencement]** No development shall commence on site until a detailed scheme, informed by an assessment of the current noise environment, for protecting the dwellings from the external noise environment of the area has been submitted to and approved, in writing, by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014 and the and that the individual noise events do not exceed 45 dB LA,max,F more than 10 times a night. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded.

Thereafter, the development shall not be carried out other than in accordance with the approved scheme which shall be completed before any part of the accommodation hereby approved is occupied, unless the Local Planning Authority otherwise agrees in writing.

REASON: These details are required due to insufficient information being contained within this submission and in order to safeguard the amenity of occupants in accordance with Policy CC8 of the Reading Borough Local Plan 2019.

This report, therefore, presents the “scheme” demonstrating that the internal sound levels will conform to the requirements of **Condition 10**, and is being submitted to Reading Borough Council for approval.

Accordingly, a brief description of the site and consented development is given in **Section 2**. The relevant noise criteria are presented in **Section 3**. The noise survey details and results are summarised in **Section 4**, whilst the scheme demonstrating compliance with the criteria is presented in **Section 5**.

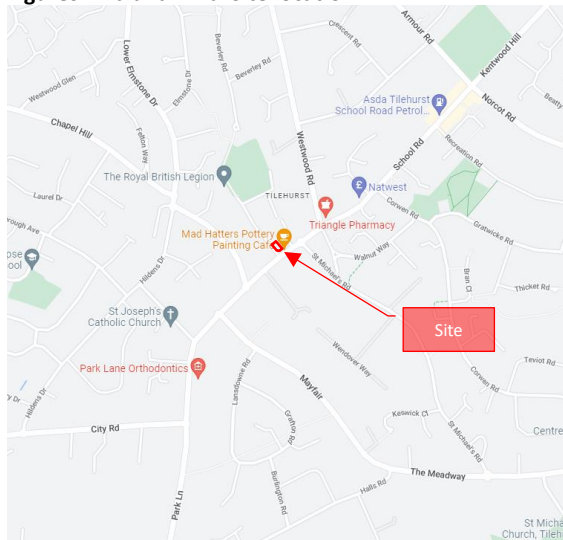
A glossary of the technical terms used in this report is presented as **Appendix A**.

## 2 SITE DESCRIPTION

### 2.1 The Application Site

The location of the site is shown in **Figures 2.1a** and **2.1b** below, with Google Street Views and a site photograph presented as **Figures 2.2, 2.3** and **2.4**.

**Figures 2.1a and 2.1b: Site location**



**Source:** Google Maps (Map data ©2022)  
(annotated by Anderson Acoustics)



**Source:** Google Maps (Imagery ©2022 Infoterra Ltd & Bluesky,  
The GeoInformation Group, Map data ©2022)  
(annotated by Anderson Acoustics)

**Figure 2.2: Google Street View from School Road (looking north at the front of the site, with Downing Road to the left)**



**Source:** ©2022 Google (Image capture: August 2021)

**Figure 2.3: Google Street View from School Road (looking west towards the site, with the fronts of the neighbouring residential and retail units shown)**



Source: ©2022 Google (Image capture: August 2021)

**Figure 2.4: View from Downing Road (looking south-east at the side/rear of the site, with the side (and residential windows) of the neighbouring mixed residential and retail building shown)**



Source: Anderson Acoustics (Image capture: May 2022)

It can be seen that the site is next to a similar, mixed-use building to the consented scheme, with a pair of semi-detached houses located the next building along.

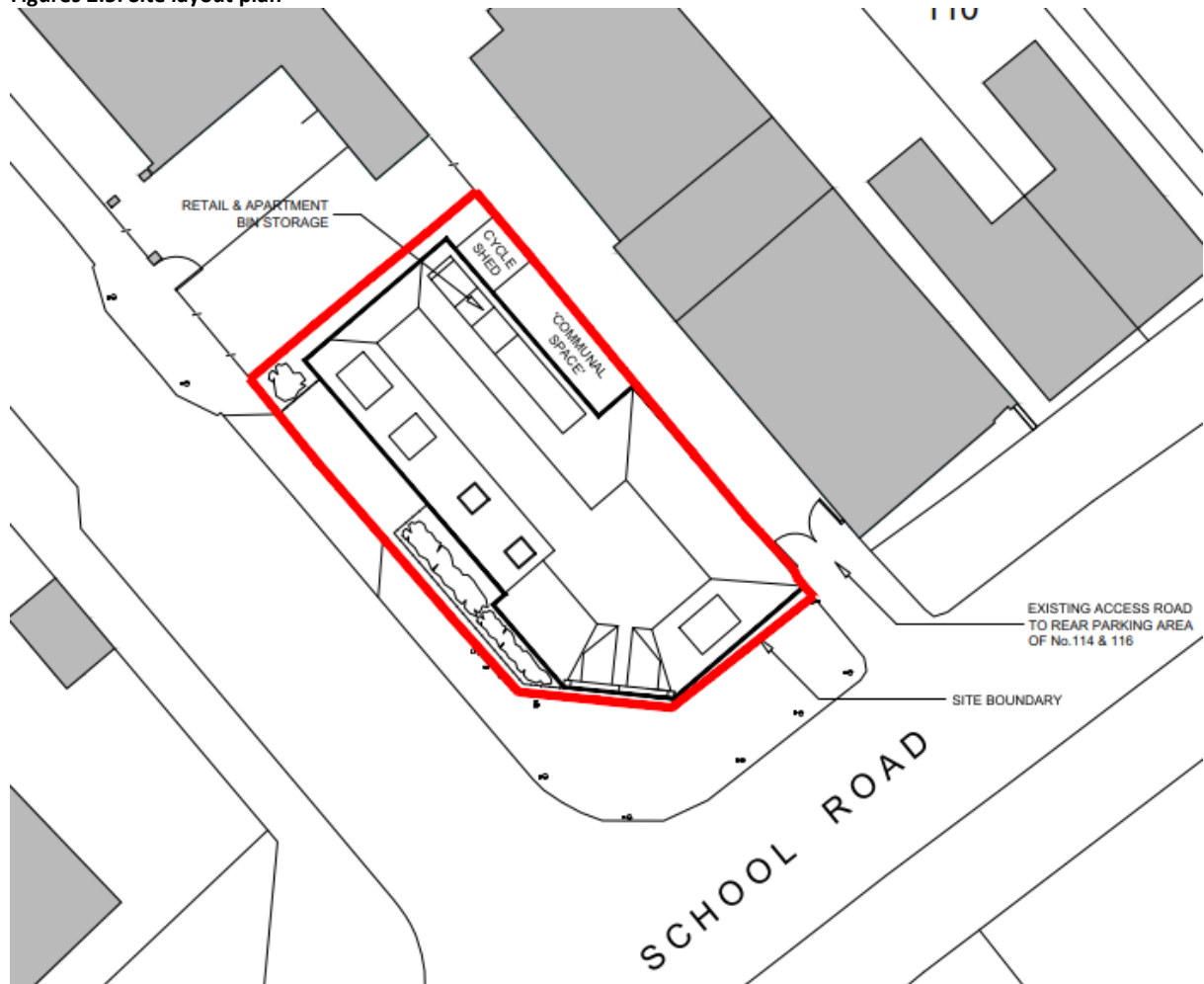
The site was visited by Anderson Acoustics during the daytime on two occasions for the purpose of the baseline survey presented in **Section 3**. The noise environment was found to be dominated by the road traffic on School Road, with some vehicle movements on Downing Road. It was deemed that a night visit wasn't warranted in the absence of any likely sources of significant commercial noise. There is The Prince public house on the other side of School Road, but where other dwellings are notably closer.

There are also the school buildings and sites next door on Downing Road and opposite, on the corner of Downing Road and School Road, but where the main source of noise from which is the associated vehicle movements, but which is not significant compared to the sound from School Road.

## 2.2 Consented Development

The development comprises the construction of new building to provide ground floor retail unit with 4 no. residential flats above. It is shown in the following figures.

**Figures 2.5: Site layout plan**



**Source:** Ascot Design Ltd ("Proposed Site Layout", ref.21 – J3733 - 01, dated July 2021)

**Figure 2.6: School Road and Downing Road elevations**



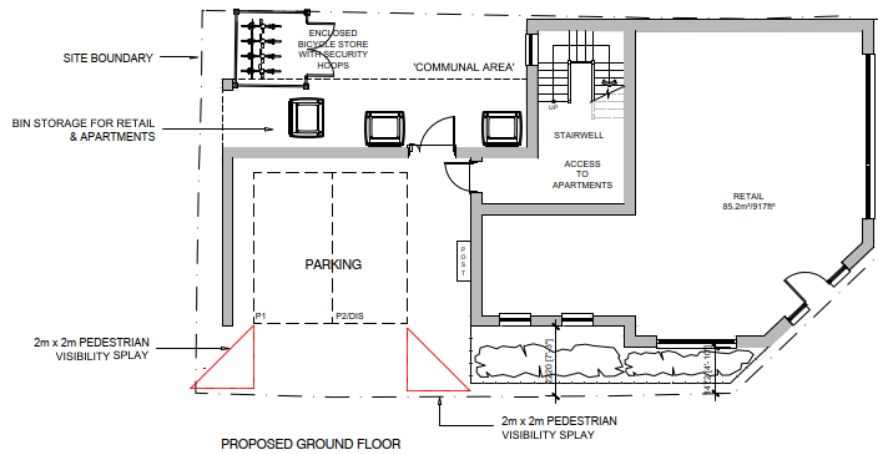
PROPOSED 'DOWNING ROAD' ELEVATION



PROPOSED 'SCHOOL ROAD' ELEVATION

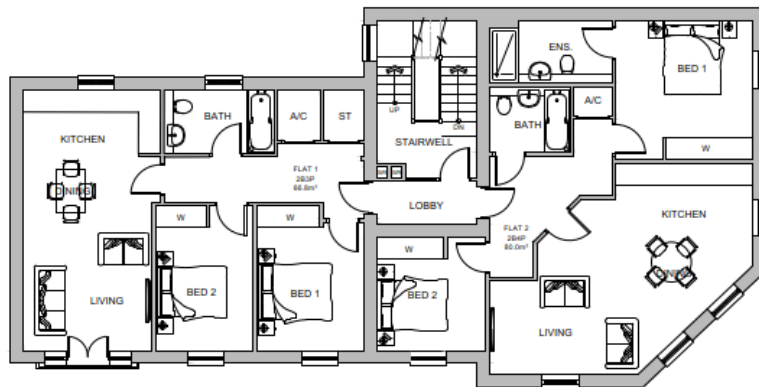
**Source:** Ascot Design Ltd ("Proposed Elevations", ref.21 – J3733 - 03, dated July 2021)

Figure 2.7: Ground floor plan



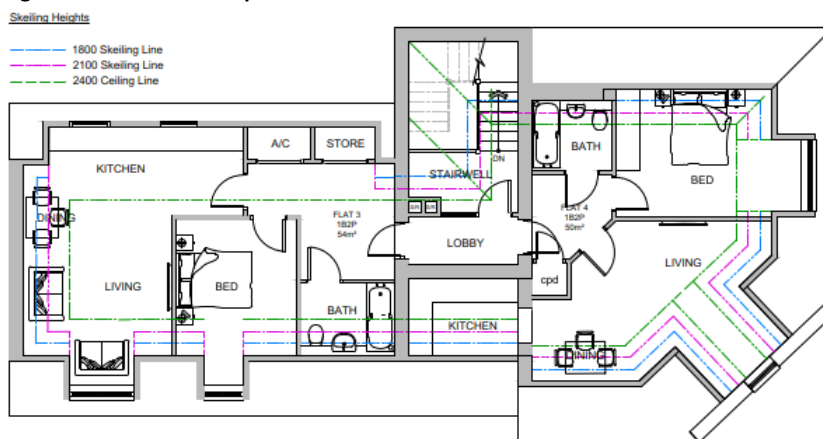
Source: Ascot Design Ltd ("Proposed Floorplans", ref.21 – J3733 - 02, dated July 2021)

Figure 2.8: First floor plan



Source: Ascot Design Ltd ("Proposed Floorplans", ref.21 – J3733 - 02, dated July 2021)

Figure 2.9: Second floor plan



Source: Ascot Design Ltd ("Proposed Floorplans", ref.21 – J3733 - 02, dated July 2021)

It can be seen that there are two flats at the front (on the first and second floors), with windows overlooking both School Road and Downing Road, and two at the rear (again on both floors), with windows overlooking either Downing Road or facing the neighbouring building.

### 3 NOISE CRITERIA

#### 3.1 Introduction and Maximum Noise Event Criteria

As is appropriate, **Condition 10** refers to **BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings** in terms of suitable internal noise criteria, which are presented below. In addition to which, specific mention is made to the requirement that “the individual noise events do not exceed 45 dB LA,max,F more than 10 times a night.” This is because **BS 8233** isn’t specific in this regard, but where this is a standard requirement based on additional guidance. The metric in question is written “LAFmax” in this report, unless quoting **Condition 10**.

#### 3.2 BS 8233 Indoor Ambient Noise Criteria

The criteria recommended in **BS 8233** for residential spaces are summarised in **Table 3.1**.

**Table 3.1: Indoor ambient noise levels for dwellings (as per Table 4 of BS 8233)**

| Activity                   | Location         | 07-23 (Daytime) | 23-07 (Night-time) |
|----------------------------|------------------|-----------------|--------------------|
| Resting                    | Living room      | 35 dB LAeq,16h  | -                  |
| Dining                     | Dining room/area | 40 dB LAeq,16h  | -                  |
| Sleeping (daytime resting) | Bedroom          | 35 dB LAeq,16h  | 30 dB LAeq,8h      |

In summary, therefore, the main criteria are 35 dB (LAeq,16h) during the day and 30 dB (LAeq,8h) at night. As per **Condition 10**, these are to apply to both any external noise breaking-in (i.e. from the road traffic) and any noise generated by the ventilation system (e.g. the MVHR system, where installed).

#### 3.3 Noise Criterion Triggering Mechanical Ventilation

**Condition 10** states that: “Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation...”

**BS 8233** doesn’t provide any guidance directly on this; however, it states that: “Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.”

Since the **BS 8233** internal criteria are in line with the WHO Guidelines, this indicates that the values presented in **Table 3.1** can be relaxed by up to 5 dB and “reasonable internal conditions still achieved.” **ProPG: Planning & Noise** (Professional Practice Guidance on Planning & Noise for New Residential Development, May 2017) expands upon this very point, stating: “The more often internal LAeq levels start to exceed the internal LAeq target levels by more than 5 dB, the more that most people are likely to regard them as “unreasonable”... Once internal LAeq 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.”

In other words, assuming the risk or occurrence of overheating is low, whereby cooling by opening windows is only required occasional, levels of at least up to 5 dB above those on **Table 3.1**, and more likely up to 10 dB, are likely to be considered reasonable. In which case, it is considered likely that the threshold in **Condition 10** is unnecessarily stringent, about around 5 dB, but where this has been accepted by the applicant.

In terms of the sound insulation performance of an open window in this regard, a value of 15 dBA is typically assumed based on guidance in **BS 8233**. This means that, assuming the levels affect living rooms and bedrooms, the equivalent external (free-field) thresholds (triggering mechanical ventilation) are 55 dB (LAeq,16h) during the day and 50 dB (LAeq,8h) at night.

## 4 BASELINE NOISE CONDITIONS

### 4.1 Introduction

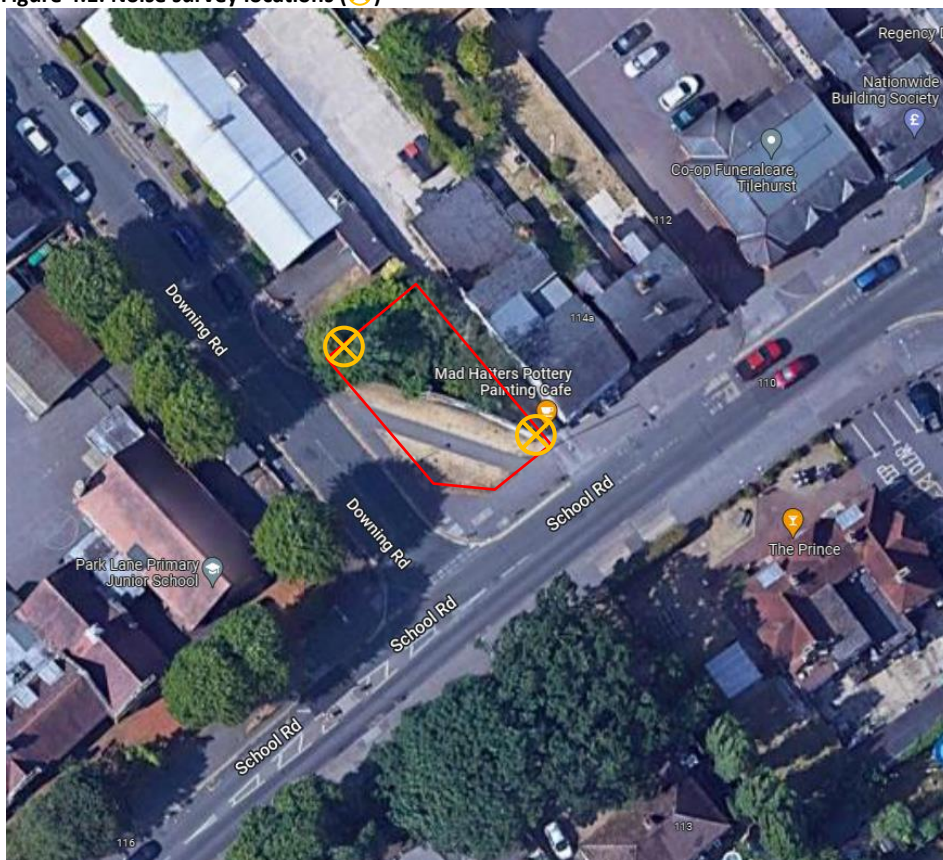
To determine the baseline noise conditions on site, two sound level meter were installed along the School Road and Downing Road boundaries on the site, roughly in line with the nearest elevations to these roads. They were installed during the **afternoon of Thursday 26<sup>th</sup> May 2022 and removed the morning of the following Wednesday, 1<sup>st</sup> June**. The meter at the front of the site operated for the entire 6/7 day period, but where the microphone extension cable at the side/rear of the site was cut through (i.e. sabotaged) on the Sunday evening, after 3/4 days' monitoring. However, more than enough data have been gathered for the purpose of a robust assessment nonetheless. This includes the fact that the second "week" of the survey was a school holiday period, but where the data (as shown below) can be seen to be very consistent despite this.

The survey details and results are presented below.

### 4.2 Survey Details

The survey locations are shown in **Figures 4.1, 4.2 and 4.3** below, whilst the equipment details are presented in **Section 4.3**. The microphones were mounted on poles such that they were between 2-3 m above the local ground with clear line of sight to the respective roads. Given the proximity of the billboard and the neighbouring building to the front position, the position is a quasi-free-field/façade, likely affected to some degree by sound reflected from these structures, but where the data are treated as if free-field as worst case. The other location was free-field, being generally away from hard, reflective vertical surfaces.

Figure 4.1: Noise survey locations (⊗)



Source: Google Maps (Imagery ©2022 Infoterra Ltd & Bluesky, The GeoInformation Group, Map data ©2022) (annotated by Anderson Acoustics)

Figure 4.2: Front/School Road noise survey location



Source: Anderson Acoustics (Image capture: may 2022)

Figure 4.3: Side/Downing Road noise survey location



Source: Anderson Acoustics (Image capture: may 2022)

The measurement chains were field-calibrated before the survey/measurements using an acoustic calibrator. The level was checked at the end of the survey/measurements, and no significant drift was observed. Both the sound level meters and calibrator have been calibrated by a UKAS accredited laboratory with the standard intervals of 24 months and 12 months, respectively.

The meters were set to store the “A” weighted sound levels every 5 minutes, from which period  $L_{eq}$  levels have been determined, together with the “Fast” time-weighted levels, from which the  $L_{max}$  and  $L_{90}$  levels have been determined. The results are presented in **Section 4.4** below and **Appendix B**.

As stated earlier, the sources audible at the times on site (i.e. during daytime hours) included the road traffic on School Road, with some vehicle movements on Downing Road. Only the road traffic on School Road being considered of significance.

At night, it is anticipated the noise environment remains dominated by the vehicles on School Road, with perhaps additional road traffic noise in the distances, with, no doubt, some natural sounds, including bird song/dawn chorus and the movement of leaves in trees.

There is a condenser unit (i.e. air-conditional plant) on the neighbouring building, as shown in **Figure 2.4** earlier, likely associated with the retail unit, but which was not observed to operate during the site visits, and with no discernible operation from the sound level data (see **Figure B.2 of Appendix B**). In any case, as shown in **Section 2.2**, the only scheme windows overlooking this location belong to non-habitable/low noise-sensitive spaces, whereby no issues are anticipated in this regard.

The weather conditions were noted at the time of the site attendance and from the BBC website during the survey. Conditions were dry, with little wind, throughout, and thus conducive to reliably data. It is not a location anticipated to be significantly affected by changes in meteorological conditions.

### 4.3 Survey Equipment Details

**Table 4.1: Survey equipment details**

| Equipment (ID)                             | Make & Model | Serial No. | Date Laboratory Calibrated                  | Calibration Certification Number <sup>1</sup> |
|--------------------------------------------|--------------|------------|---------------------------------------------|-----------------------------------------------|
| School Road Sound Level Meter (AA-SLM-09)  | Rion NL-52   | 610202     | 22 <sup>nd</sup> December 2020 <sup>2</sup> | UCRT20/2264                                   |
| Downing Road Sound Level Meter (AA-SLM-11) | Rion NL-52   | 732147     | 18 <sup>th</sup> December 2020 <sup>2</sup> | UCRT20/2259                                   |
| Calibrator (AA-CAL-05)                     | Rion NC-74   | 35015349   | 5 <sup>th</sup> April 2022 <sup>3</sup>     | 1502107-3                                     |

1 Certificates available on request.

2 Valid for two years.

3 Valid for one year.

### 4.4 Survey Results

The 5-minutely results are presented in chart form in **Appendix B**, with the period  $L_{Aeq,T}$  levels and the night-time  $L_{AFmax}$  levels, as most relevant to the assessment, presented overleaf. Strictly, the  $L_{AFmax}$  levels should be determined on an “event” basis. Since, as is often the case for long term data, levels are available on a period basis only – 5-minutes in this case – and where there are naturally many similar events when it comes to road traffic noise, a percentile-based approach is typically adopted, with the 90<sup>th</sup> percentile level considered representative of “typical” maximum noise conditions.

**Table 4.2: Summary of measured/determined sound levels, dB**

| Date (2022)              | Daytime (07-23) $L_{Aeq,16h}$ <sup>1</sup> |                             | Night-time (23-07)        |                |                                                      |                |
|--------------------------|--------------------------------------------|-----------------------------|---------------------------|----------------|------------------------------------------------------|----------------|
|                          |                                            |                             | $L_{Aeq,8h}$ <sup>1</sup> |                | 90 <sup>th</sup> Percentile $L_{AFmax}$ <sup>2</sup> |                |
|                          | School Rd                                  | Downing Rd                  | School Rd                 | Downing Rd     | School Rd                                            | Downing Rd     |
| Thu 26 May               | 64 <sup>3</sup>                            | 54 <sup>3</sup>             | 60                        | 50             | 80                                                   | 69             |
| Fri 27 May               | 66                                         | 58                          | 59                        | 49             | 79                                                   | 68             |
| Sat 28 May               | 66                                         | 56                          | 60                        | 53             | 81                                                   | 74             |
| Sun 29 May               | 65                                         | 54                          | 58                        | - <sup>4</sup> | 78                                                   | - <sup>4</sup> |
| Mon 30 May               | 65                                         | - <sup>4</sup>              | 59                        | - <sup>4</sup> | 78                                                   | - <sup>4</sup> |
| Tue 31 May               | 66                                         | - <sup>4</sup>              | 60                        | - <sup>4</sup> | 79                                                   | - <sup>4</sup> |
| <b>Average (Highest)</b> | <b>66 <sup>5</sup> (66)</b>                | <b>56 <sup>5</sup> (58)</b> | <b>59 (60)</b>            | <b>51 (53)</b> | <b>79 (81)</b>                                       | <b>70 (74)</b> |

1 Based on the logarithmic average of the  $L_{Aeq,5min}$  levels.

2 Used on the 5-minute levels as an alternative to the 10<sup>th</sup> highest “event” level.

3 Part data from after the equipment was installed.

4 No data due to cable being cut.

5 Excluding part data.

The following are observed from the above data:

- All levels are very consistent, with, typically, no more than 2 dB between the average and highest levels. The exception being the  $L_{AFmax}$  data at the Downing Road position, but where this is more to be expected being away for the dominant source of noise, and thus susceptible to other sources and greater variation. Whilst, in any case, the variation is relatively modest, and where the data overall are considered representative of a robust dataset.
- The difference between the average of the daytime and night  $L_{Aeq,T}$  levels at the School Road location is 7 dB, which is within the range to be expected in such a location. Since the day and night-time  $L_{Aeq,T}$  noise criteria (see **Table 3.1**) are 5 dB apart, this broadly means (subject to other factors, like room and glazing dimensions) that meeting the daytime criterion will be slightly “harder” than the equivalent night-time criterion. See the next point, however.
- The difference between the night-time  $L_{Aeq,8h}$  and  $L_{AFmax}$  levels is 20 dB on average. Since the difference between the criteria for these metrics is 15 dB, meeting the  $L_{AFmax}$  criterion will be (subject, again, to various factors) slightly “harder” than the equivalent night-time criterion.
- The difference between the average of the daytime and night  $L_{Aeq,T}$  levels at the Downing Road location is lower at 4 dB, which is at the lower end of what would be expected (but certainly not unusual). Not quite following the same trend at the School Road location is an indication that, not so surprisingly, this location was not entirely dominated by the School Road traffic, with other sources, particularly at night (so likely distant road traffic), adding to the measured levels.
- The differences between the corresponding levels at the two locations are between 8 and 10 dB, which will be a factor of both the increased distance from School Road and the reduced view. This range ties in with a quick calculation to account for these two factors, which indicates the lack of contribution of noise from Downing Road.

Overall, the data is as expected.

## 4.5 Future conditions

In terms of the dominant source of noise, i.e. the road traffic on School Road, we see no reason to expect in the foreseeable future that noise conditions will be materially different than those presented in this report. Whilst there would appear to be limited potential for future development or additional noise sources that may affect the scheme, or that the scheme itself may affect.

## 5 CONDITION 10 NOISE CONTROL SCHEME

### 5.1 Ventilation

Key to considering controlling noise break-in is the means of ventilation (and cooling). As discussed, the stringent approach is taken by **Condition 10** requiring “mechanical ventilation” “where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels...”, which, as per **Section 3.3**, results in external trigger levels of 55 dB ( $L_{Aeq,16h}$ ) during the day and 50 dB ( $L_{Aeq,8h}$ ) at night.

It can be seen from **Table 4.2** that, with the exception of a single night-time level at the Downing Road position, the measured levels meet or exceed these thresholds, meaning that the required for mechanical ventilation is triggered.

**Accordingly, the applicant has accepted the requirement for MVHR units in all four flats**, as per the example given in **Condition 10**. Whilst, as per the related requirements in **Condition 10**, the systems will include a summer bypass setting and will meet the relevant **BS 8233** criteria during normal operation.

Given the use of MVHR units, there will be no requirement for trickle/background ventilation units, and which can therefore be discounted from the assessment presented below.

### 5.2 Windows (and other building envelope elements)

**Condition 10** requires that the internal sound levels conform to the standards identified by **BS 8233**. These are presented in **Table 4.1**, where a level of 35 dB  $L_{Aeq,16h}$  applies to living rooms and bedrooms during the day, and a level of 30 dB  $L_{Aeq,8h}$  applies to bedrooms at night. In addition, though not given in **BS 8233**, a level of 45 dB  $L_{AFmax}$  would also typically apply to bedrooms at night, as per **Condition 10**.

It should be borne in mind that, as stated in **BS 8233**, these levels are based on annual average data and do not have to be achieved in all circumstances.

Having established that mechanical ventilation will be provided, whilst also representing an alternative means of cooling, the assessment against the internal noise criteria can be based on windows being closed, which has been done following the ‘more rigorous calculation’ method set out in **BS 8233**<sup>1</sup>.

The method is based on details of the external (free-field) sound levels and sound insulation performances of the building components in the octave frequency bands between 125 Hz and 4000 Hz, whilst taking into account the acoustic nature of the internal spaces in question and the various room and element dimensions. The latter have been based on the architect’s drawings, as presented in **Section 2.2**; the element performances have been taken from manufacturer, or other relevant, literature; whilst the sound level data has been determined from survey data.

The sound level data are presented in **Table 5.1**. Where distances to the windows in question vary significantly from the measurement locations, corrections have been applied based on geometric spreading from line sources in terms of the  $L_{eq}$  data and point sources in terms of the  $L_{Fmax}$  data.

<sup>1</sup> The method is based on that in BS EN 12354-3:2000, which our calculation spreadsheet is based upon.

**Table 5.1: Adopted external sound levels**

| Flat                                                                                   | Window(s)                  | Metric              | External (free-field) Sound Levels (dB) at Octave Band Frequencies (Hz) |     |     |    |    |    | Equivalent dBA |
|----------------------------------------------------------------------------------------|----------------------------|---------------------|-------------------------------------------------------------------------|-----|-----|----|----|----|----------------|
|                                                                                        |                            |                     | 125                                                                     | 250 | 500 | 1k | 2k | 4k |                |
| Flat 1 (1 <sup>st</sup> floor, at the rear/ overlooking Downing Road)                  | Living Room/ Kitchen-Diner | L <sub>eq,16h</sub> | 64                                                                      | 60  | 50  | 50 | 46 | 41 | 56             |
|                                                                                        | Bed 1 & Bed 2              | L <sub>eq,8h</sub>  | 65                                                                      | 55  | 45  | 46 | 41 | 34 | 53             |
|                                                                                        |                            | L <sub>Fmax</sub>   | 83                                                                      | 72  | 63  | 66 | 62 | 51 | 72             |
| Flat 2 (1 <sup>st</sup> floor, at the front/ overlooking School Road and Downing Road) | Living Room/ Kitchen-Diner | L <sub>eq,16h</sub> | 74                                                                      | 70  | 60  | 60 | 56 | 51 | 66             |
|                                                                                        | Bed 1                      | L <sub>eq,8h</sub>  | 71                                                                      | 61  | 51  | 52 | 47 | 40 | 59             |
|                                                                                        |                            | L <sub>Fmax</sub>   | 90                                                                      | 79  | 70  | 73 | 69 | 58 | 79             |
|                                                                                        | Bed 2                      | L <sub>eq,16h</sub> | 68                                                                      | 64  | 54  | 54 | 50 | 45 | 60             |
|                                                                                        |                            | L <sub>eq,8h</sub>  | 69                                                                      | 59  | 49  | 50 | 45 | 38 | 57             |
|                                                                                        |                            | L <sub>Fmax</sub>   | 85                                                                      | 74  | 65  | 68 | 64 | 53 | 74             |
| Flat 3 (2 <sup>nd</sup> floor at the rear/ overlooking Downing Road)                   | Living Room/ Kitchen-Diner | L <sub>eq,16h</sub> | 64                                                                      | 60  | 50  | 50 | 46 | 41 | 56             |
|                                                                                        | Bed                        | L <sub>eq,8h</sub>  | 65                                                                      | 55  | 45  | 46 | 41 | 34 | 53             |
|                                                                                        |                            | L <sub>Fmax</sub>   | 83                                                                      | 72  | 63  | 66 | 62 | 51 | 72             |
| Flat 4 (2 <sup>nd</sup> floor at the front/ overlooking School Road)                   | Living Room/ Diner         | L <sub>eq,16h</sub> | 71                                                                      | 67  | 57  | 57 | 53 | 48 | 63             |
|                                                                                        | Bed                        | L <sub>eq,8h</sub>  | 68                                                                      | 58  | 48  | 49 | 44 | 37 | 56             |
|                                                                                        |                            | L <sub>Fmax</sub>   | 85                                                                      | 74  | 65  | 68 | 64 | 53 | 74             |

For the non-glazed façade elements, the following sound insulation performances are applicable to the scheme.

**Table 5.2: Acoustic performance of the walls and roof**

| Element                                                                              | Description                                                          | SRIs (dB) at Octave Band Frequencies (Hz) |     |     |    |    |    | Equivalent R <sub>w</sub> (C <sub>tr</sub> )/D <sub>n,eW</sub> (C <sub>tr</sub> ) |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------|-----|-----|----|----|----|-----------------------------------------------------------------------------------|
|                                                                                      |                                                                      | 125                                       | 250 | 500 | 1k | 2k | 4k |                                                                                   |
| Wall (applicable to the 1 <sup>st</sup> floor and the 2 <sup>nd</sup> floor in part) | Brick-block cavity wall                                              | 41                                        | 45  | 45  | 54 | 58 | 58 | 52(-4)                                                                            |
| Roof (applicable to the 2 <sup>nd</sup> floor)                                       | Tiled roof, 25 mm plasterboard ceiling, 100 mm sound absorbing layer | 27                                        | 37  | 43  | 48 | 52 | 52 | 46(-7)                                                                            |

Based on the above, and the room and element dimensions, required window specifications have been determined. The calculation sheets are presented in **Appendix C**. In all instances, based on the test data provided (see **Appendix D**) the following specification has been determined as being sufficient to achieve the **Condition 10** internal noise criteria.

**Table 5.3: Acoustic performance of the windows units**

| Flat                                                                                   | Window(s)                  | Spec. (all "Duraflex 70mm Diamond suite" single casement windows) | SRIs (dB) at Octave Band Frequencies (Hz) |     |     |    |    |    | R <sub>w</sub> (C <sub>tr</sub> ) |
|----------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------|-------------------------------------------|-----|-----|----|----|----|-----------------------------------|
|                                                                                        |                            |                                                                   | 125                                       | 250 | 500 | 1k | 2k | 4k |                                   |
| Flat 1 (1 <sup>st</sup> floor, at the rear/ overlooking Downing Road)                  | Living Room/ Kitchen-Diner | 4 / 18 / 6                                                        | 23                                        | 32  | 36  | 43 | 38 | 39 | 38(-5)                            |
|                                                                                        | Bed 1 & Bed 2              |                                                                   |                                           |     |     |    |    |    |                                   |
| Flat 2 (1 <sup>st</sup> floor, at the front/ overlooking School Road and Downing Road) | Living Room/ Kitchen-Diner | 4 / 18 / 6.8                                                      | 22                                        | 32  | 37  | 43 | 41 | 43 | 39(-6)                            |
|                                                                                        | Bed 1                      |                                                                   |                                           |     |     |    |    |    |                                   |
|                                                                                        | Bed 2                      | 4 / 18 / 6                                                        | 23                                        | 32  | 36  | 43 | 38 | 39 | 38(-5)                            |
| Flat 3 (2 <sup>nd</sup> floor at the rear/ overlooking Downing Road)                   | Living Room/ Kitchen-Diner | 4 / 18 / 6                                                        | 23                                        | 32  | 36  | 43 | 38 | 39 | 38(-5)                            |
|                                                                                        | Bed                        |                                                                   |                                           |     |     |    |    |    |                                   |
| Flat 4 (2 <sup>nd</sup> floor at the front/ overlooking School Road)                   | Living Room/ Diner         | 4 / 18 / 6.8                                                      | 22                                        | 32  | 37  | 43 | 41 | 43 | 39(-6)                            |
|                                                                                        | Bed                        | 6 / 14 / 8.8                                                      | 25                                        | 34  | 39  | 44 | 43 | 47 | 39(-6)                            |

It can be seen from the calculation sheets presented in **Appendix C** that **the criteria are met in all instances**. Accordingly, the noise control scheme is represented by the use of MVHR units (as **per Section 5.1**) and the use of the building elements presented in **Tables 5.2** and **5.3**. The windows will be openable at the occupants' discretion.

This report is summarised in the **Executive Summary** presented at the beginning of the report.

# APPENDIX A

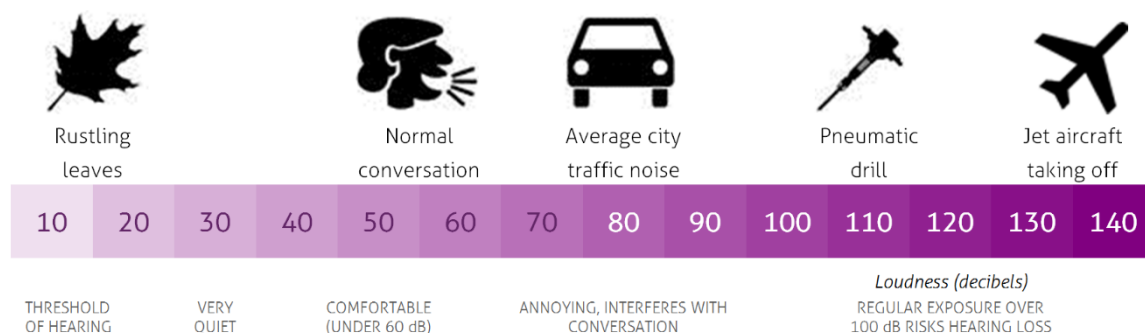
## GLOSSARY OF TERMINOLOGY

There is a ten million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Sound is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB) scale. Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure sound is therefore weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A), dBA or  $L_{Aeq}$  for example (see also below).

It is generally accepted that under normal conditions humans are capable of detecting changes in steady sound levels of 3 dB, whilst a change of 10 dB is perceived as a doubling or halving of the sound level. An indication of the range of sound levels commonly found in the environment is given below.

Figure A1: Typical sound levels



A number of different indices are used to describe the fluctuations in sound level over certain time periods. The main indices include:

- $L_{A90,T}$**  This is the sound level exceeded for 90% of the measurement period and provides a measurement of relatively continuous sounds that make up quieter 'lull' periods in between sound events. It is often referred to as the background sound level, and usually measured using the 'fast' time response (hence sometimes written  $L_{AF90,T}$ ).
- $L_{Aeq,T}$**  This is the "equivalent continuous A weighted sound pressure level" and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period. It is often used for measuring all sources of sound in the environment, which can be referred to as the ambient sound.
- $L_{Amax,F}$**  This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response. Also written  $L_{Amax,fast}$  OR  $L_{AFmax}$ .

Reference is often made to acoustic measurements being undertaken in 'free-field' or 'façade' locations. Free-field measurements represent a location away from vertical reflecting surfaces, normally by at least 3.5 m. A façade measurement is taken or calculated to a position 1 m from an external façade and a correction of up to 3 dB can be applied to account for the sound reflected from the façade. This latter position is often used when assessing the impact of external noise affecting residents inside properties.

In terms of the use of "sound" and "noise", strictly "sound" can be measured by a sound level meter or other measuring system, whilst "noise" is related to a human response, and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive. Care has been taken in this document to use the most relevant of these terms; however, in most reference documents, and, indeed, generally, these terms are used interchangeably, with noise being used, in correctly, more often than sound, and so a mix is presented in this document. Consequently, just because the term noise is used, doesn't necessarily mean a negative effect exists or will occur, and the context of the accompanying text should be taken into account. Further definitions relating to this report are given overleaf.

## Definitions

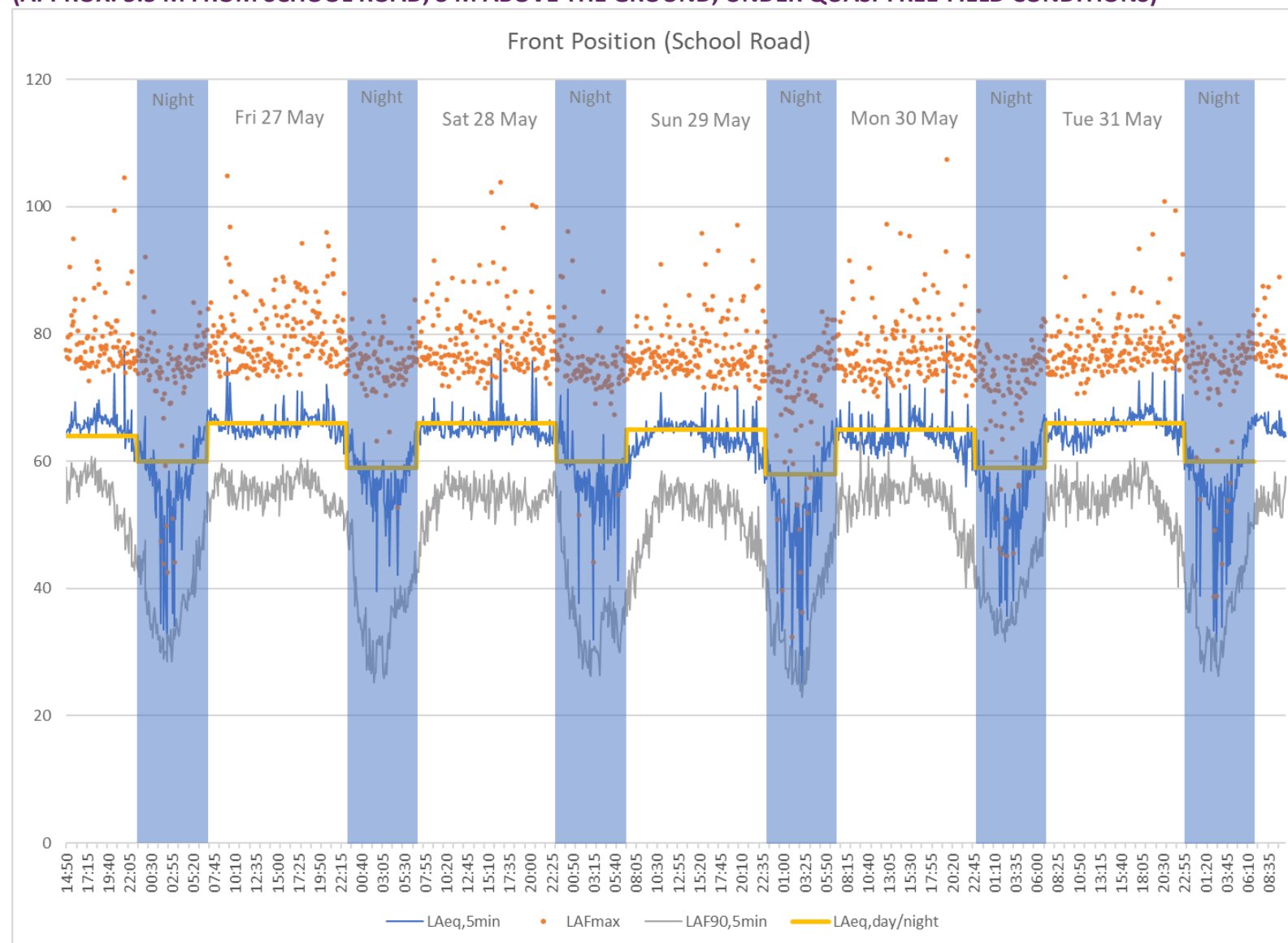
- Airborne Sound: Sound that reaches the point of interest by propagation through air.
- Ambient Sound: Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.
- A-weighting, dB(A): The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
- Background sound: Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.
- Calibration: The measurement system/ chain should be periodically calibrated, within a laboratory, against traceable calibration instrumentation, to either National Standards or as UKAS-Accredited, as required. The calibration of the system should also be checked in the field using a portable calibrator before and after each short term measurements, and periodically for longer term monitoring.
- $C_{tr}$ : Correction/adaption term applied against the sound insulation single-number values ( $R_w$ ,  $D_w$ , and  $D_{nT,w}$ ) to provide a weighting for low frequency performance. The reference values used within the  $C_{tr}$  calculation are based on urban traffic sound.
- Decibel (dB): A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds ( $s_1$  and  $s_2$ ) is given by  $20 \log_{10} (s_1/s_2)$ . The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is  $20 \mu\text{Pa}$ .
- Dwelling: A building used for living purposes. A mobile home used for permanent living should be included in an assessment. If calculations are being conducted for compensation purposes, then some mobile homes are dealt with under the Highways Noise Payments and Moveable Homes Regulations.
- Façade/ Façade Level: At a distance of 1 m in front of a large sound reflecting object such as a building façade. According to BS 8233:2014, "Façade level measurements of  $L_{pA}$  are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the façade." The Calculation of Road Traffic Noise (1988) uses 2.5 dB, whilst BS 5228-1:2009+A1:2014 recommends 3 dB. Owing to the latter examples, together with other historical documents, it is more usual to apply 3 dB.
- Fast time-weighting (F): Averaging time used in sound level meters. Defined in BS EN 61672-2:2013 *Electroacoustics. Sound level meters. Pattern evaluation tests*.
- Free-field/ Free-field Level: Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m away.
- Hertz (Hz): The unit of Frequency or Pitch of a sound. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
- IOA: The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society (a daughter society of the Institution of Mechanical Engineers). It is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels. Our consultants/engineers are individual Members.
- $L_{AF10,T}$ : The A-weighted sound pressure level exceeded for 10% of the time over the period, T, measured using fast time-weighting (F), see below. It can be considered to be the "average maximum" sound level, and is generally used to describe road traffic noise.
- $L_{AF90,T}$ : The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time fast time-weighting (F). Generally used to describe the 'background' sound conditions.

- **L<sub>AFmax</sub>**: The maximum A-weighted sound pressure level during a given time period. **L<sub>max</sub>** is sometimes used for the assessment of occasional loud sounds, which may have little effect on the overall **L<sub>eq</sub>** noise level, but could still affect the sound environment. Unless described otherwise, it is measured using the fast time-weighting (F).
- **L<sub>eq,T</sub>**: A sound level index called the equivalent continuous sound level over the time period, T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. Where the value is A-weighted, it will be presented 'L<sub>Aeq,T</sub>' or 'dBA L<sub>eq,T</sub>', otherwise it should be an un-weighted (or linear) value.
- **L<sub>p</sub>**: See Sound Pressure Level.
- **Octave/ octave band**: Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit. For example, the 1000 Hz (1 kHz) octave band contains noise energy at all frequencies from 707 to 1414 Hz.
- **Percentile Level**: The sound pressure level exceeded for N% of a specified time interval, see **L<sub>AF90,T</sub>** etc.
- **R**: See Sound Reduction Index.
- **R<sub>w</sub>**: See Weighted Sound Reduction Index.
- **Sound Level Metrics, Indices or Parameters**: Sound levels usually fluctuate over time, so it is often necessary to consider an average or statistical sound level. This can be done in several ways, so a number of different metrics have been defined, according to how the averaging or statistics are carried out.
- **Sound Pressure Level (Sound Level), L<sub>p</sub>**: The sound level is the sound pressure relative to a standard reference pressure of 20 µPa (20x10<sup>-6</sup> Pascals) on a decibel scale.
- **Sound Pressure**: Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
- **Sound reduction index (SRI), R**: Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.
- **Weighted sound reduction index (SRI), R<sub>w</sub>**: Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies as measured in a laboratory.

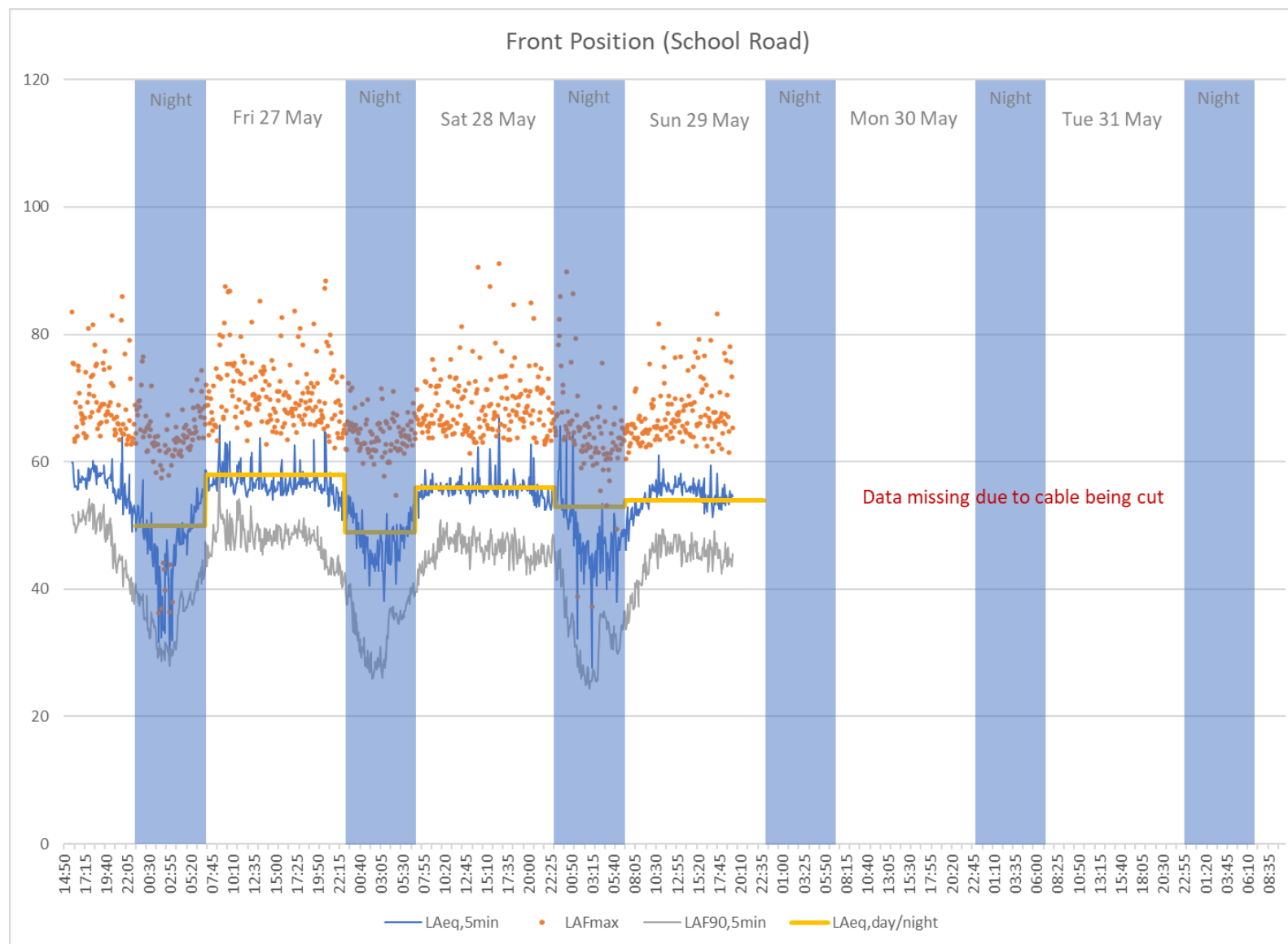
# APPENDIX B

## NOISE SURVEY DATA

**NOISE SURVEY DATA FROM THE FRONT/SCHOOL ROAD POSITION**  
**(APPROX. 5.5 M FROM SCHOOL ROAD, 3 M ABOVE THE GROUND, UNDER QUASI-FREE-FIELD CONDITIONS)**



**NOISE SURVEY DATA FROM THE REAR/DOWNING ROAD POSITION**  
**(APPROX. 3 M FROM DOWNING ROAD, 26 M FROM SCHOOL ROAD, 2 M ABOVE THE GROUND, UNDER FREE-FIELD CONDITIONS)**



# APPENDIX C

## BS 8233 CALCULATIONS

## FLAT 1

### Anderson Acoustics Ltd

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 1 1st Floor Kitchen/Living Room

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 23 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -12 dB                     |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          | Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|---------|----------------------|------|----------------|----------------------------------|-----|-----|------|------|------|-------|
|         |                      |      |                | 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
|         | Reverberation Time   | 0.5  | s              | 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |
|         | Receiver Room Volume | 69.0 | m <sup>3</sup> |                                  |     |     |      |      |      |       |

#### Element 1

|         |                         |                    |    |    |    |    |     |     |         |           |
|---------|-------------------------|--------------------|----|----|----|----|-----|-----|---------|-----------|
| L1      | Wall (database)         | Leq                | 64 | 60 | 50 | 50 | 46  | 41  | 56      | 48 Rw+Ctr |
| -R      | Brick-block cavity wall |                    | 41 | 45 | 45 | 54 | 58  | 58  | Rw = 52 |           |
| +10logS | Element Area            | 5.1 m <sup>2</sup> | 7  | 7  | 7  | 7  | 7   | 7   |         |           |
| -10logA | where A=0.16V/T         |                    | 13 | 13 | 13 | 13 | 13  | 13  |         |           |
| +3      |                         |                    | 3  | 3  | 3  | 3  | 3   | 3   |         |           |
| =L2     |                         |                    | 20 | 12 | 2  | -7 | -15 | -20 | 7       |           |
| L2tot   | Running total           |                    | 20 | 12 | 2  | -7 | -15 | -20 | 7       |           |

#### Element 2

|         |                    |                    |    |    |    |    |    |    |         |           |
|---------|--------------------|--------------------|----|----|----|----|----|----|---------|-----------|
| L1      | Window (user data) | Len                | 64 | 60 | 50 | 50 | 46 | 41 | 56      | 34 Rw+Ctr |
| -R      | 4 / 18 / 6         |                    | 23 | 32 | 36 | 43 | 38 | 39 | Rw = 39 |           |
| +10logS | Element Area       | 4.6 m <sup>2</sup> | 7  | 7  | 7  | 7  | 7  | 7  |         |           |
| -10logA | where A=0.16V/T    |                    | 13 | 13 | 13 | 13 | 13 | 13 |         |           |
| +3      |                    |                    | 3  | 3  | 3  | 3  | 3  | 3  |         |           |
| =L2     |                    |                    | 37 | 24 | 10 | 3  | 4  | -2 | 22      |           |
| L2tot   | Running total      |                    | 37 | 24 | 11 | 4  | 4  | -2 | 23      |           |

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 1 1st Floor Bedrooms

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 20 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -15 dB                     |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          | Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|---------|----------------------|------|----------------|----------------------------------|-----|-----|------|------|------|-------|
|         |                      |      |                | 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
|         | Reverberation Time   | 0.5  | s              | 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |
|         | Receiver Room Volume | 38.0 | m <sup>3</sup> |                                  |     |     |      |      |      |       |

#### Element 1

|         |                         |                    |    |    |    |    |     |     |                      |
|---------|-------------------------|--------------------|----|----|----|----|-----|-----|----------------------|
| L1      | Wall (database)         | Leq                | 64 | 60 | 50 | 50 | 46  | 41  | 56                   |
| -R      | Brick-block cavity wall |                    | 41 | 45 | 45 | 54 | 58  | 58  | Rw = 52<br>48 Rw+Ctr |
| +10logS | Element Area            | 9.0 m <sup>2</sup> | 10 | 10 | 10 | 10 | 10  | 10  |                      |
| -10logA | where A=0.16V/T         |                    | 11 | 11 | 11 | 11 | 11  | 11  |                      |
| +3      |                         |                    | 3  | 3  | 3  | 3  | 3   | 3   |                      |
| =L2     |                         |                    | 25 | 17 | 7  | -2 | -10 | -15 |                      |
| L2tot   | Running total           |                    | 25 | 17 | 7  | -2 | -10 | -15 | 12                   |

#### Element 2

|         |                    |        |    |    |    |    |    |    |         |           |
|---------|--------------------|--------|----|----|----|----|----|----|---------|-----------|
| L1      | Window (user data) | Leq    | 64 | 60 | 50 | 50 | 46 | 41 | 56      | 34 Rw+Ctr |
| -R      | 4 / 18 / 6         |        | 23 | 32 | 36 | 43 | 38 | 39 | Rw = 39 |           |
| +10logS | Element Area       | 1.3 m² | 1  | 1  | 1  | 1  | 1  | 1  |         |           |
| -10logA | where A=0.16V/T    |        | 11 | 11 | 11 | 11 | 11 | 11 |         |           |
| +3      |                    |        | 3  | 3  | 3  | 3  | 3  | 3  |         |           |
| =L2     |                    |        | 34 | 21 | 7  | 0  | 1  | -5 | 19      |           |
| L2tot   | Running total      |        | 35 | 22 | 10 | 2  | 1  | -4 | 20      |           |

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Night     |
| Predicted Internal Level: | 20 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 30 dB L <sub>Aeq,10h</sub> |
| Difference:               | -10 dB                     |

| Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|----------------------------------|-----|-----|------|------|------|-------|
| 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
| 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |

| Free-field |    |    |    |     |     | 53<br>Rw = |
|------------|----|----|----|-----|-----|------------|
| 65         | 55 | 45 | 46 | 41  | 34  |            |
| 41         | 45 | 45 | 54 | 58  | 58  |            |
| 10         | 10 | 10 | 10 | 10  | 10  |            |
| 11         | 11 | 11 | 11 | 11  | 11  |            |
| 3          | 3  | 3  | 3  | 3   | 3   |            |
| 26         | 12 | 2  | -6 | -15 | -22 | 11         |
| 26         | 12 | 2  | -6 | -15 | -22 | 11         |

| 65 | 55 | 45 | 46 | 41 | 34  | 53      |
|----|----|----|----|----|-----|---------|
| 23 | 32 | 36 | 43 | 38 | 39  | Rw = 39 |
| 1  | 1  | 1  | 1  | 1  | 1   |         |
| 11 | 11 | 11 | 11 | 11 | 11  |         |
| 3  | 3  | 3  | 3  | 3  | 3   |         |
| 35 | 16 | 2  | -4 | -4 | -12 | 19      |
| 36 | 17 | 5  | -2 | -4 | -11 | 20      |

### Anderson Acoustics Ltd

|                           |                         |
|---------------------------|-------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Amax</sub> Night |
| Predicted Internal Level: | 38 dB L <sub>Amax</sub> |
| Criterion:                | 45 dB L <sub>Amax</sub> |
| Difference:               | -7 dB                   |

| Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|----------------------------------|-----|-----|------|------|------|-------|
| 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
| 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |

| Free-field |    |    |    |    |    | 72<br><br>Rw = 52 |
|------------|----|----|----|----|----|-------------------|
| 83         | 72 | 63 | 66 | 62 | 51 |                   |
| 41         | 45 | 45 | 54 | 58 | 58 |                   |
| 10         | 10 | 10 | 10 | 10 | 10 |                   |
| 11         | 11 | 11 | 11 | 11 | 11 |                   |
| 3          | 3  | 3  | 3  | 3  | 3  |                   |
| 44         | 29 | 20 | 14 | 6  | -5 | 29                |
| 44         | 29 | 20 | 14 | 6  | -5 | 29                |

| 83 | 72 | 63 | 66 | 62 | 51 | 72      |
|----|----|----|----|----|----|---------|
| 23 | 32 | 36 | 43 | 38 | 39 | Rw = 39 |
| 1  | 1  | 1  | 1  | 1  | 1  |         |
| 11 | 11 | 11 | 11 | 11 | 11 |         |
| 3  | 3  | 3  | 3  | 3  | 3  |         |
| 53 | 33 | 20 | 16 | 17 | 5  | 37      |
| 54 | 34 | 23 | 18 | 17 | 6  | 38      |

## FLAT 2

### Anderson Acoustics Ltd

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 2 1st Floor Kitchen/Living Room

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 34 dB L <sub>Aeq,16h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,16h</sub> |
| Difference:               | -1 dB                      |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          | Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|---------|----------------------|------|----------------|----------------------------------|-----|-----|------|------|------|-------|
|         |                      |      |                | 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
|         | Reverberation Time   | 0.5  | s              | 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |
|         | Receiver Room Volume | 67.5 | m <sup>3</sup> |                                  |     |     |      |      |      |       |

#### Element 1

| L1      | Wall (database)         | Leq  | 74 | 70 | 60 | 60 | 56 | 51 | 66 |         |
|---------|-------------------------|------|----|----|----|----|----|----|----|---------|
| -R      | Brick-block cavity wall |      | 41 | 45 | 45 | 54 | 58 | 58 |    | Rw = 52 |
| +10logS | Element Area            | 26.6 | 14 | 14 | 14 | 14 | 14 | 14 |    |         |
| -10logA | where A=0.16V/T         |      | 13 | 13 | 13 | 13 | 13 | 13 |    |         |
| +3      |                         |      | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                         |      | 37 | 29 | 19 | 10 | 2  | -3 | 24 |         |
| L2tot   | Running total           |      | 37 | 29 | 19 | 10 | 2  | -3 | 24 |         |

#### Element 2

| L1      | Window (user data) | Leq | 74 | 70 | 60 | 60 | 56 | 51 | 66 |         |
|---------|--------------------|-----|----|----|----|----|----|----|----|---------|
| -R      | 4 / 18 / 6         |     | 23 | 32 | 36 | 43 | 38 | 39 |    | Rw = 39 |
| +10logS | Element Area       | 5.0 | 7  | 7  | 7  | 7  | 7  | 7  |    |         |
| -10logA | where A=0.16V/T    |     | 13 | 13 | 13 | 13 | 13 | 13 |    |         |
| +3      |                    |     | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                    |     | 48 | 35 | 21 | 14 | 15 | 9  | 33 |         |
| L2tot   | Running total      |     | 48 | 36 | 23 | 15 | 15 | 9  | 34 |         |

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 2 1st Floor Front Bedroom

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 30 dB L <sub>Aeq,16h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,16h</sub> |
| Difference:               | -5 dB                      |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          | Octave band centre frequency, Hz |     |     |      |      |      | dB[A] |
|---------|----------------------|------|----------------|----------------------------------|-----|-----|------|------|------|-------|
|         |                      |      |                | 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
|         | Reverberation Time   | 0.5  | s              | 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |
|         | Receiver Room Volume | 38.0 | m <sup>3</sup> |                                  |     |     |      |      |      |       |

#### Element 1

| L1      | Wall (database)         | Leq | 74 | 70 | 60 | 60 | 56 | 51 | 66 |         |
|---------|-------------------------|-----|----|----|----|----|----|----|----|---------|
| -R      | Brick-block cavity wall |     | 41 | 45 | 45 | 54 | 58 | 58 |    | Rw = 52 |
| +10logS | Element Area            | 9.0 | 10 | 10 | 10 | 10 | 10 | 10 |    |         |
| -10logA | where A=0.16V/T         |     | 11 | 11 | 11 | 11 | 11 | 11 |    |         |
| +3      |                         |     | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                         |     | 35 | 27 | 17 | 8  | 0  | -5 | 22 |         |
| L2tot   | Running total           |     | 35 | 27 | 17 | 8  | 0  | -5 | 22 |         |

#### Element 2

| L1      | Window (user data) | Leq | 74 | 70 | 60 | 60 | 56 | 51 | 66 |         |
|---------|--------------------|-----|----|----|----|----|----|----|----|---------|
| -R      | 4 / 18 / 6.8       |     | 24 | 31 | 37 | 42 | 41 | 43 |    | Rw = 40 |
| +10logS | Element Area       | 1.3 | 1  | 1  | 1  | 1  | 1  | 1  |    |         |
| -10logA | where A=0.16V/T    |     | 11 | 11 | 11 | 11 | 11 | 11 |    |         |
| +3      |                    |     | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                    |     | 43 | 32 | 16 | 11 | 8  | 1  | 29 |         |
| L2tot   | Running total      |     | 44 | 33 | 19 | 13 | 9  | 2  | 30 |         |

|                           |                           |
|---------------------------|---------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Night    |
| Predicted Internal Level: | 25 dB L <sub>Aeq,8h</sub> |
| Criterion:                | 30 dB L <sub>Aeq,8h</sub> |
| Difference:               | -5 dB                     |

| Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|----------------------------------|-----|-----|------|------|------|-------|
| 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
| 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |

| Free-field |    |    |    |    |     | RW = |
|------------|----|----|----|----|-----|------|
| 71         | 61 | 51 | 52 | 47 | 40  |      |
| 41         | 45 | 45 | 54 | 58 | 58  |      |
| 10         | 10 | 10 | 10 | 10 | 10  |      |
| 11         | 11 | 11 | 11 | 11 | 11  |      |
| 3          | 3  | 3  | 3  | 3  | 3   |      |
| 32         | 18 | 8  | 0  | -9 | -16 |      |
| 32         | 18 | 8  | 0  | -9 | -16 |      |

| 71 | 61 | 51 | 52 | 47 | 40  | 59   |
|----|----|----|----|----|-----|------|
| 24 | 31 | 37 | 42 | 41 | 43  | Rw = |
| 1  | 1  | 1  | 1  | 1  | 1   |      |
| 11 | 11 | 11 | 11 | 11 | 11  |      |
| 3  | 3  | 3  | 3  | 3  | 3   |      |
| 40 | 23 | 7  | 3  | -1 | -10 | 25   |
| 41 | 24 | 10 | 5  | 0  | -9  | 25   |

### Anderson Acoustics Ltd

|                           |                         |
|---------------------------|-------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Amax</sub> Night |
| Predicted Internal Level: | 44 dB L <sub>Amax</sub> |
| Criterion:                | 45 dB L <sub>Amax</sub> |
| Difference:               | -1 dB                   |

| Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|----------------------------------|-----|-----|------|------|------|-------|
| 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
| 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |

| Free-field |    |    |    |    |    | 79       |
|------------|----|----|----|----|----|----------|
| 90         | 79 | 70 | 73 | 69 | 58 |          |
| 41         | 45 | 45 | 54 | 58 | 58 | fww = 52 |
| 10         | 10 | 10 | 10 | 10 | 10 |          |
| 11         | 11 | 11 | 11 | 11 | 11 |          |
| 3          | 3  | 3  | 3  | 3  | 3  |          |
| 51         | 36 | 27 | 21 | 13 | 2  |          |
| 51         | 36 | 27 | 21 | 13 | 2  | 36       |

| 90 | 79 | 70 | 73 | 69 | 58 | 79    |
|----|----|----|----|----|----|-------|
| 24 | 31 | 37 | 42 | 41 | 43 | Rw=40 |
| 1  | 1  | 1  | 1  | 1  | 1  |       |
| 11 | 11 | 11 | 11 | 11 | 11 |       |
| 3  | 3  | 3  | 3  | 3  | 3  |       |
| 59 | 41 | 26 | 24 | 21 | 8  | 44    |
| 60 | 42 | 29 | 26 | 22 | 9  | 44    |

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 2 1st Floor Side Bedroom

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          |
|---------|----------------------|------|----------------|
|         | Reverberation Time   | 0.5  | s              |
|         | Receiver Room Volume | 38.0 | m <sup>3</sup> |

#### Element 1

|         |                         |                    |
|---------|-------------------------|--------------------|
| L1      | Wall (database)         | Leq                |
| -R      | Brick-block cavity wall |                    |
| +10logS | Element Area            | 9.0 m <sup>2</sup> |
| -10logA | where A=0.16V/T         |                    |
| +3      |                         |                    |
| =L2     |                         |                    |
| L2tot   | Running total           |                    |

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 24 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -11 dB                     |

| Octave band centre frequency, Hz |       |
|----------------------------------|-------|
| 125 250 500 1000 2000 4000       | dB(A) |

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
|-----|-----|-----|-----|-----|-----|

| Free-field |    |    |    |    |     |                     |
|------------|----|----|----|----|-----|---------------------|
| 68         | 64 | 54 | 54 | 50 | 45  | 60                  |
| 41         | 45 | 45 | 54 | 58 | 58  | R <sub>w</sub> = 52 |
| 10         | 10 | 10 | 10 | 10 | 10  |                     |
| 11         | 11 | 11 | 11 | 11 | 11  |                     |
| 3          | 3  | 3  | 3  | 3  | 3   |                     |
| 29         | 21 | 11 | 2  | -6 | -11 | 16                  |
| 29         | 21 | 11 | 2  | -6 | -11 | 16                  |

48 R<sub>w</sub>+Ctr

#### Element 2

|         |                    |                    |
|---------|--------------------|--------------------|
| L1      | Window (user data) | Leq                |
| -R      | 4 / 18 / 6         |                    |
| +10logS | Element Area       | 1.5 m <sup>2</sup> |
| -10logA | where A=0.16V/T    |                    |
| +3      |                    |                    |
| =L2     |                    |                    |
| L2tot   | Running total      |                    |

| 68 | 64 | 54 | 54 | 50 | 45 | 60                  |
|----|----|----|----|----|----|---------------------|
| 23 | 32 | 36 | 43 | 38 | 39 | R <sub>w</sub> = 39 |
| 1  | 1  | 1  | 1  | 1  | 1  |                     |
| 11 | 11 | 11 | 11 | 11 | 11 |                     |
| 3  | 3  | 3  | 3  | 3  | 3  |                     |
| 38 | 25 | 11 | 4  | 5  | -1 | 23                  |
| 39 | 26 | 14 | 6  | 5  | 0  | 24                  |

34 R<sub>w</sub>+Ctr

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Night     |
| Predicted Internal Level: | 24 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 30 dB L <sub>Aeq,10h</sub> |
| Difference:               | -6 dB                      |

| Octave band centre frequency, Hz |       |
|----------------------------------|-------|
| 125 250 500 1000 2000 4000       | dB(A) |

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
|-----|-----|-----|-----|-----|-----|

| Free-field |    |    |    |     |     |                     |
|------------|----|----|----|-----|-----|---------------------|
| 69         | 59 | 49 | 50 | 45  | 38  | 57                  |
| 41         | 45 | 45 | 54 | 58  | 58  | R <sub>w</sub> = 52 |
| 10         | 10 | 10 | 10 | 10  | 10  |                     |
| 11         | 11 | 11 | 11 | 11  | 11  |                     |
| 3          | 3  | 3  | 3  | 3   | 3   |                     |
| 30         | 16 | 6  | -2 | -11 | -18 | 15                  |
| 30         | 16 | 6  | -2 | -11 | -18 | 15                  |

| 69 | 59 | 49 | 50 | 45 | 38 | 57                  |
|----|----|----|----|----|----|---------------------|
| 23 | 32 | 36 | 43 | 38 | 39 | R <sub>w</sub> = 39 |
| 1  | 1  | 1  | 1  | 1  | 1  |                     |
| 11 | 11 | 11 | 11 | 11 | 11 |                     |
| 3  | 3  | 3  | 3  | 3  | 3  |                     |
| 39 | 20 | 6  | 0  | 0  | -8 | 23                  |
| 40 | 21 | 9  | 2  | 0  | -7 | 24                  |

|                           |                         |
|---------------------------|-------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Amax</sub> Night |
| Predicted Internal Level: | 40 dB L <sub>Amax</sub> |
| Criterion:                | 45 dB L <sub>Amax</sub> |
| Difference:               | -5 dB                   |

| Octave band centre frequency, Hz |       |
|----------------------------------|-------|
| 125 250 500 1000 2000 4000       | dB(A) |

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
|-----|-----|-----|-----|-----|-----|

| Free-field |    |    |    |    |    |                     |
|------------|----|----|----|----|----|---------------------|
| 85         | 74 | 65 | 68 | 64 | 53 | 74                  |
| 41         | 45 | 45 | 54 | 58 | 58 | R <sub>w</sub> = 52 |
| 10         | 10 | 10 | 10 | 10 | 10 |                     |
| 11         | 11 | 11 | 11 | 11 | 11 |                     |
| 3          | 3  | 3  | 3  | 3  | 3  |                     |
| 46         | 31 | 22 | 16 | 8  | -3 | 31                  |
| 46         | 31 | 22 | 16 | 8  | -3 | 31                  |

| 85 | 74 | 65 | 68 | 64 | 53 | 74                  |
|----|----|----|----|----|----|---------------------|
| 23 | 32 | 36 | 43 | 38 | 39 | R <sub>w</sub> = 39 |
| 1  | 1  | 1  | 1  | 1  | 1  |                     |
| 11 | 11 | 11 | 11 | 11 | 11 |                     |
| 3  | 3  | 3  | 3  | 3  | 3  |                     |
| 55 | 35 | 22 | 18 | 19 | 7  | 39                  |
| 56 | 36 | 25 | 20 | 19 | 8  | 40                  |

## FLAT 3

### Anderson Acoustics Ltd

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 3 2nd Floor Kitchen/Living Room

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 24 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -11 dB                     |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          | Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|---------|----------------------|------|----------------|----------------------------------|-----|-----|------|------|------|-------|
|         |                      |      |                | 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
|         | Reverberation Time   | 0.5  | s              | 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |
|         | Receiver Room Volume | 41.7 | m <sup>3</sup> |                                  |     |     |      |      |      |       |

#### Element 1

| L1      | Roof (database)                                                                               | Leq | 64 | 60 | 50 | 50 | 46 | 41  | 56 |         |
|---------|-----------------------------------------------------------------------------------------------|-----|----|----|----|----|----|-----|----|---------|
| -R      | Tiled/slated roof, 25mm plasterboard ceiling, sound absorbing layer (e.g. 100mm mineral wool) |     | 27 | 37 | 43 | 48 | 52 | 52  |    | Rw = 46 |
| +10logS | Element Area                                                                                  | 7.4 | 9  | 9  | 9  | 9  | 9  | 9   |    |         |
| -10logA | where A=0.16V/T                                                                               |     | 11 | 11 | 11 | 11 | 11 | 11  |    |         |
| +3      |                                                                                               |     | 3  | 3  | 3  | 3  | 3  | 3   |    |         |
| =L2     |                                                                                               |     | 37 | 23 | 7  | 2  | -6 | -11 | 22 |         |
| L2tot   | Running total                                                                                 |     | 37 | 23 | 7  | 2  | -6 | -11 | 22 |         |

#### Element 2

| L1      | Window (user data) | Leq | 64 | 60 | 50 | 50 | 46 | 41 | 56 |         |
|---------|--------------------|-----|----|----|----|----|----|----|----|---------|
| -R      | 4 / 18 / 6         |     | 23 | 32 | 36 | 43 | 38 | 39 |    | Rw = 39 |
| +10logS | Element Area       | 1.8 | 2  | 2  | 2  | 2  | 2  | 2  |    |         |
| -10logA | where A=0.16V/T    |     | 11 | 11 | 11 | 11 | 11 | 11 |    |         |
| +3      |                    |     | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                    |     | 35 | 22 | 8  | 1  | 2  | -4 | 20 |         |
| L2tot   | Running total      |     | 39 | 26 | 11 | 5  | 3  | -3 | 24 |         |

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 3 2nd Floor Bedroom

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Day       |
| Predicted Internal Level: | 25 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -10 dB                     |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data | Units          | Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|---------|----------------------|------|----------------|----------------------------------|-----|-----|------|------|------|-------|
|         |                      |      |                | 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
|         | Reverberation Time   | 0.5  | s              | 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |
|         | Receiver Room Volume | 24.5 | m <sup>3</sup> |                                  |     |     |      |      |      |       |

#### Element 1

| L1      | Roof (database)                                                                               | Leq | 64 | 60 | 50 | 50 | 46 | 41 | 56 |         |
|---------|-----------------------------------------------------------------------------------------------|-----|----|----|----|----|----|----|----|---------|
| -R      | Tiled/slated roof, 25mm plasterboard ceiling, sound absorbing layer (e.g. 100mm mineral wool) |     | 27 | 37 | 43 | 48 | 52 | 52 |    | Rw = 46 |
| +10logS | Element Area                                                                                  | 6.2 | 8  | 8  | 8  | 8  | 8  | 8  |    |         |
| -10logA | where A=0.16V/T                                                                               |     | 9  | 9  | 9  | 9  | 9  | 9  |    |         |
| +3      |                                                                                               |     | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                                                                                               |     | 39 | 25 | 9  | 4  | -4 | -9 | 24 |         |
| L2tot   | Running total                                                                                 |     | 39 | 25 | 9  | 4  | -4 | -9 | 24 |         |

#### Element 2

| L1      | Window (user data) | Leq | 64 | 60 | 50 | 50 | 46 | 41 | 56 |         |
|---------|--------------------|-----|----|----|----|----|----|----|----|---------|
| -R      | 4 / 18 / 6         |     | 23 | 32 | 36 | 43 | 38 | 39 |    | Rw = 39 |
| +10logS | Element Area       | 1.0 | 0  | 0  | 0  | 0  | 0  | 0  |    |         |
| -10logA | where A=0.16V/T    |     | 9  | 9  | 9  | 9  | 9  | 9  |    |         |
| +3      |                    |     | 3  | 3  | 3  | 3  | 3  | 3  |    |         |
| =L2     |                    |     | 35 | 22 | 8  | 1  | 2  | -4 | 20 |         |
| L2tot   | Running total      |     | 40 | 27 | 12 | 6  | 3  | -3 | 25 |         |

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Aeq</sub> Night     |
| Predicted Internal Level: | 26 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 30 dB L <sub>Aeq,10h</sub> |
| Difference:               | -4 dB                      |

| Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|----------------------------------|-----|-----|------|------|------|-------|
| 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
| 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |

| Free-field |    |    |    |    |     | 53      |
|------------|----|----|----|----|-----|---------|
| 65         | 55 | 45 | 46 | 41 | 34  |         |
| 27         | 37 | 43 | 48 | 52 | 52  | Row = 4 |
| 8          | 8  | 8  | 8  | 8  | 8   |         |
| 9          | 9  | 9  | 9  | 9  | 9   |         |
| 3          | 3  | 3  | 3  | 3  | 3   |         |
| 40         | 20 | 4  | 0  | -9 | -16 | 24      |
| 40         | 20 | 4  | 0  | -9 | -16 | 24      |

| 65 | 55 | 45 | 46 | 41 | 34  | 53      |
|----|----|----|----|----|-----|---------|
| 23 | 32 | 36 | 43 | 38 | 39  | Row = 3 |
| 0  | 0  | 0  | 0  | 0  | 0   |         |
| 9  | 9  | 9  | 9  | 9  | 9   |         |
| 3  | 3  | 3  | 3  | 3  | 3   |         |
| 36 | 17 | 3  | -3 | -3 | -11 | 20      |
| 41 | 22 | 7  | 2  | -2 | -10 | 26      |

### Anderson Acoustics Ltd

|                           |                         |
|---------------------------|-------------------------|
| <b>RESULT SUMMARY:</b>    | L <sub>Amax</sub> Night |
| Predicted Internal Level: | 44 dB L <sub>Amax</sub> |
| Criterion:                | 45 dB L <sub>Amax</sub> |
| Difference:               | -1 dB                   |

| Octave band centre frequency, Hz |     |     |      |      |      | dB(A) |
|----------------------------------|-----|-----|------|------|------|-------|
| 125                              | 250 | 500 | 1000 | 2000 | 4000 |       |
| 0.5                              | 0.5 | 0.5 | 0.5  | 0.5  | 0.5  |       |

| Free-field |    |    |    |    |    | 72     |
|------------|----|----|----|----|----|--------|
| 83         | 72 | 63 | 66 | 62 | 51 |        |
| 27         | 37 | 43 | 48 | 52 | 52 | Rw = 4 |
| 8          | 8  | 8  | 8  | 8  | 8  |        |
| 9          | 9  | 9  | 9  | 9  | 9  |        |
| 3          | 3  | 3  | 3  | 3  | 3  |        |
| 58         | 37 | 22 | 20 | 12 | 1  | 42     |
| 58         | 37 | 22 | 20 | 12 | 1  | 42     |

| 83 | 72 | 63 | 66 | 62 | 51 | 72       |
|----|----|----|----|----|----|----------|
| 23 | 32 | 36 | 43 | 38 | 39 | Row = 30 |
| 0  | 0  | 0  | 0  | 0  | 0  |          |
| 9  | 9  | 9  | 9  | 9  | 9  |          |
| 3  | 3  | 3  | 3  | 3  | 3  |          |
| 54 | 34 | 21 | 17 | 18 | 6  | 38       |
| 59 | 39 | 25 | 22 | 19 | 7  | 44       |

## FLAT 4

### Anderson Acoustics Ltd

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 4 2nd Floor Kitchen/Living Room

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    |                            |
| L <sub>Aeq</sub> Day      | 34 dB L <sub>Aeq,10h</sub> |
| Predicted Internal Level: | 35 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -1 dB                      |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data                | Units | Octave band centre frequency, Hz |       |
|---------|----------------------|---------------------|-------|----------------------------------|-------|
|         |                      |                     |       | 125 250 500 1000 2000 4000       | dB(A) |
|         | Reverberation Time   | 0.5 s               |       | 0.5 0.5 0.5 0.5 0.5 0.5          |       |
|         | Receiver Room Volume | 52.8 m <sup>3</sup> |       |                                  |       |

#### Element 1

|         |                         |                    |                      |         |
|---------|-------------------------|--------------------|----------------------|---------|
| L1      | Wall (database)         | Leq                | 71 67 57 57 55 48 63 |         |
| -R      | Brick-block cavity wall |                    | 41 45 45 54 58 58    | Rw = 52 |
| +10logS | Element Area            | 1.3 m <sup>2</sup> | 1 1 1 1 1 1          |         |
| -10logA | where A=0.16V/T         |                    | 12 12 12 12 12 12    |         |
| +3      |                         |                    | 3 3 3 3 3 3          |         |
| =L2     |                         |                    | 22 14 4 -5 -11 -18   | 9       |
| L2tot   | Running total           |                    | 22 14 4 -5 -11 -18   | 9       |

#### Element 2

|         |                    |                    |                      |         |
|---------|--------------------|--------------------|----------------------|---------|
| L1      | Window (user data) | Leq                | 71 67 57 57 55 48 63 |         |
| -R      | 4 / 16 / 6.8       |                    | 22 32 37 43 41 43    | Rw = 40 |
| +10logS | Element Area       | 1.3 m <sup>2</sup> | 1 1 1 1 1 1          |         |
| -10logA | where A=0.16V/T    |                    | 12 12 12 12 12 12    |         |
| +3      |                    |                    | 3 3 3 3 3 3          |         |
| =L2     |                    |                    | 41 27 12 6 6 -3      | 26      |
| L2tot   | Running total      |                    | 41 27 12 6 6 -3      | 26      |

#### Element 3

|         |                                                                                              |                     |                      |         |
|---------|----------------------------------------------------------------------------------------------|---------------------|----------------------|---------|
| L1      | Roof (database)                                                                              | Leq                 | 71 67 57 57 55 48 63 |         |
| -R      | Tiled/slated roof, 25mm plasterboard ceiling, sound absorbing layer (e.g. 100m mineral wool) |                     | 27 37 43 48 52 52    | Rw = 46 |
| +10logS | Element Area                                                                                 | 21.1 m <sup>2</sup> | 13 13 13 13 13 13    |         |
| -10logA | where A=0.16V/T                                                                              |                     | 12 12 12 12 12 12    |         |
| +3      |                                                                                              |                     | 3 3 3 3 3 3          |         |
| =L2     |                                                                                              |                     | 48 34 18 13 7 0      | 33      |
| L2tot   | Running total                                                                                |                     | 49 35 19 14 9 2      | 34      |

Job name: 114-116 School Road  
Job no.: 5945  
Façade: Flat 4 2nd Floor Bedroom

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    |                            |
| L <sub>Aeq</sub> Day      | 32 dB L <sub>Aeq,10h</sub> |
| Predicted Internal Level: | 35 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 35 dB L <sub>Aeq,10h</sub> |
| Difference:               | -3 dB                      |

#### SOUND INSULATION BY ELEMENT

| Formula | Description          | Data                | Units | Octave band centre frequency, Hz |       |
|---------|----------------------|---------------------|-------|----------------------------------|-------|
|         |                      |                     |       | 125 250 500 1000 2000 4000       | dB(A) |
|         | Reverberation Time   | 0.5 s               |       | 0.5 0.5 0.5 0.5 0.5 0.5          |       |
|         | Receiver Room Volume | 30.8 m <sup>3</sup> |       |                                  |       |

#### Element 1

|         |                                                                                              |                    |                      |         |
|---------|----------------------------------------------------------------------------------------------|--------------------|----------------------|---------|
| L1      | Roof (database)                                                                              | Leq                | 71 67 57 57 53 48 63 |         |
| -R      | Tiled/slated roof, 25mm plasterboard ceiling, sound absorbing layer (e.g. 100m mineral wool) |                    | 27 37 43 48 52 52    | Rw = 46 |
| +10logS | Element Area                                                                                 | 5.8 m <sup>2</sup> | 8 8 8 8 8 8          |         |
| -10logA | where A=0.16V/T                                                                              |                    | 10 10 10 10 10 10    |         |
| +3      |                                                                                              |                    | 3 3 3 3 3 3          |         |
| =L2     |                                                                                              |                    | 45 31 15 10 2 -3     | 30      |
| L2tot   | Running total                                                                                |                    | 45 31 15 10 2 -3     | 30      |

#### Element 2

|         |                    |                    |                      |         |
|---------|--------------------|--------------------|----------------------|---------|
| L1      | Window (user data) | Leq                | 71 67 57 57 53 48 63 |         |
| -R      | 5 / 16 / 8.8       |                    | 25 34 39 44 43 47    | Rw = 42 |
| +10logS | Element Area       | 2.8 m <sup>2</sup> | 3 3 3 3 3 3          |         |
| -10logA | where A=0.16V/T    |                    | 10 10 10 10 10 10    |         |
| +3      |                    |                    | 3 3 3 3 3 3          |         |
| =L2     |                    |                    | 42 29 14 9 6 -3      | 27      |
| L2tot   | Running total      |                    | 47 33 18 13 8 0      | 32      |

|                           |                            |
|---------------------------|----------------------------|
| <b>RESULT SUMMARY:</b>    |                            |
| L <sub>Aeq</sub> Night    | 28 dB L <sub>Aeq,10h</sub> |
| Predicted Internal Level: | 30 dB L <sub>Aeq,10h</sub> |
| Criterion:                | 30 dB L <sub>Aeq,10h</sub> |
| Difference:               | -2 dB                      |

| Octave band centre frequency, Hz |       |
|----------------------------------|-------|
| 125 250 500 1000 2000 4000       | dB(A) |
| 0.5 0.5 0.5 0.5 0.5 0.5          |       |

|                      |         |
|----------------------|---------|
| <b>Free-field</b>    |         |
| 68 58 48 49 44 37 56 |         |
| 27 37 43 48 52 52    | Rw = 46 |
| 8 8 8 8 8 8          |         |
| 10 10 10 10 10 10    |         |
| 3 3 3 3 3 3          |         |
| 42 22 6 2 -7 -14     | 26      |
| 42 22 6 2 -7 -14     | 26      |

|                      |         |
|----------------------|---------|
| 68 58 48 49 44 37 56 |         |
| 25 34 39 44 43 47    | Rw = 42 |
| 3 3 3 3 3 3          |         |
| 10 10 10 10 10 10    |         |
| 3 3 3 3 3 3          |         |
| 39 20 5 1 -3 -14     | 24      |
| 44 24 9 5 -1 -11     | 28      |

### Anderson Acoustics Ltd

|                           |                         |
|---------------------------|-------------------------|
| <b>RESULT SUMMARY:</b>    |                         |
| L <sub>Amax</sub> Night   | 45 dB L <sub>Amax</sub> |
| Predicted Internal Level: | 45 dB L <sub>Amax</sub> |
| Criterion:                | 45 dB L <sub>Amax</sub> |
| Difference:               | 0 dB                    |

| Octave band centre frequency, Hz |       |
|----------------------------------|-------|
| 125 250 500 1000 2000 4000       | dB(A) |
| 0.5 0.5 0.5 0.5 0.5 0.5          |       |

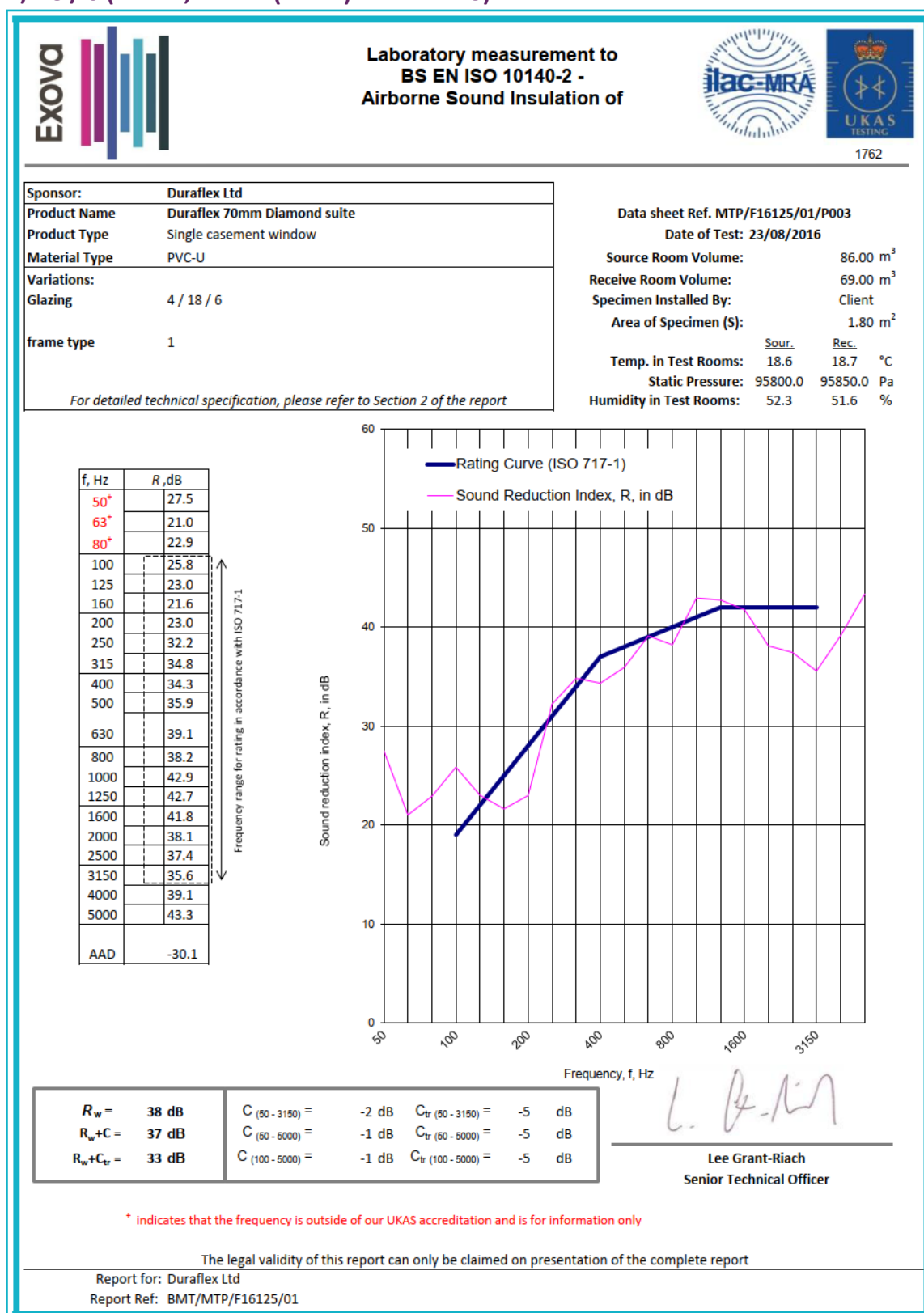
|                      |         |
|----------------------|---------|
| <b>Free-field</b>    |         |
| 85 74 65 68 64 53 74 |         |
| 27 37 43 48 52 52    | Rw = 46 |
| 8 8 8 8 8 8          |         |
| 10 10 10 10 10 10    |         |
| 3 3 3 3 3 3          |         |
| 59 38 23 21 13 2     | 43      |
| 59 38 23 21 13 2     | 43      |

|                      |         |
|----------------------|---------|
| 85 74 65 68 64 53 74 |         |
| 25 34 39 44 43 47    | Rw = 42 |
| 3 3 3 3 3 3          |         |
| 10 10 10 10 10 10    |         |
| 3 3 3 3 3 3          |         |
| 56 36 22 20 17 2     | 41      |
| 61 40 26 24 19 5     | 45      |

# APPENDIX D

## GLAZING UNIT TEST DATA

4 / 18 / 6 (FLAT 1, FLAT 2 (BED 2) AND FLAT 3)



4 / 18 / 6.8 (FLAT 2 (LIVING ROOM & BED 1) AND FLAT 4 (LIVING ROOM))



Laboratory measurement to  
BS EN ISO 10140-2 -  
Airborne Sound Insulation of

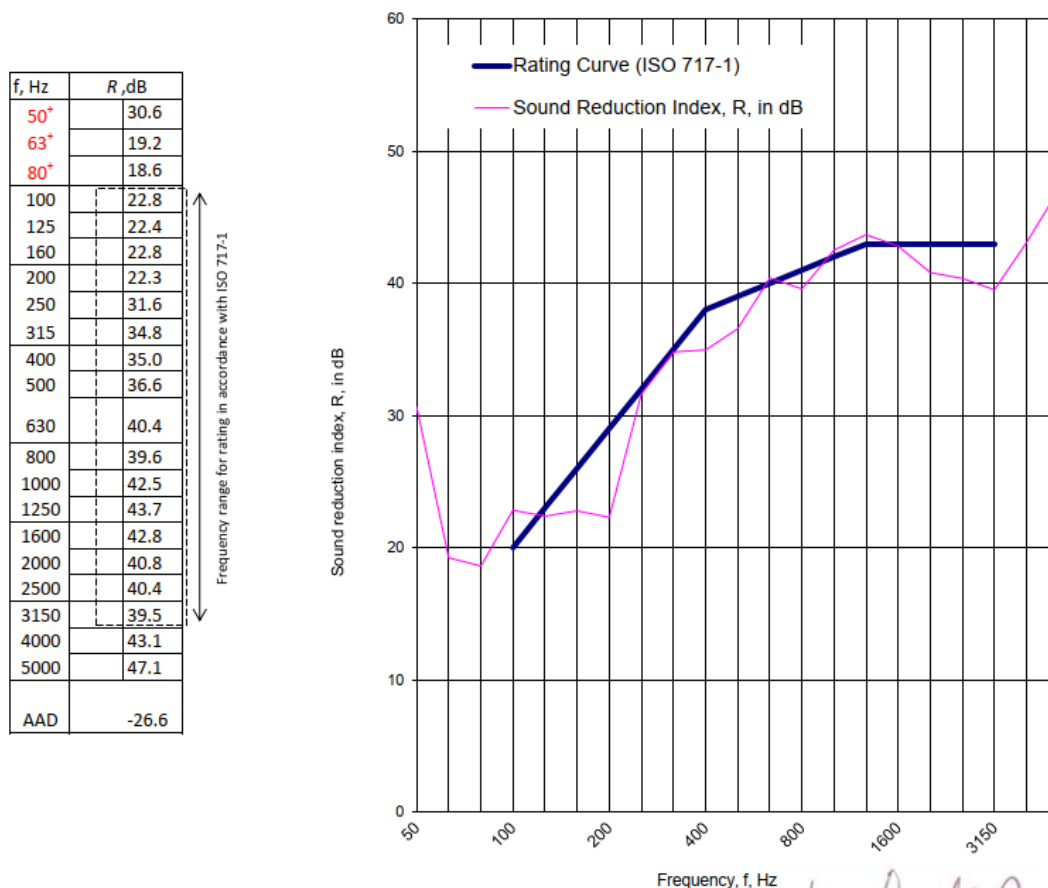


1762

|               |                             |
|---------------|-----------------------------|
| Sponsor:      | Duraflex Ltd                |
| Product Name  | Duraflex 70mm Diamond suite |
| Product Type  | Single casement window      |
| Material Type | PVC-U                       |
| Variations:   |                             |
| Glazing       | 4 / 18 / 6.8                |
| frame type    | 1                           |

For detailed technical specification, please refer to Section 2 of the report

|                         |                         |
|-------------------------|-------------------------|
| Data sheet Ref.         | MTP/F16125/01/P004      |
| Date of Test:           | 23/08/2016              |
| Source Room Volume:     | 86.00 m <sup>3</sup>    |
| Receive Room Volume:    | 69.00 m <sup>3</sup>    |
| Specimen Installed By:  | Client                  |
| Area of Specimen (S):   | 1.80 m <sup>2</sup>     |
| Temp. in Test Rooms:    | Sour. 18.6 Rec. 18.7 °C |
| Static Pressure:        | 95800.0 95850.0 Pa      |
| Humidity in Test Rooms: | 52.3 51.6 %             |



|                  |       |                    |       |                      |       |
|------------------|-------|--------------------|-------|----------------------|-------|
| $R_w =$          | 39 dB | $C_{(50-3150)} =$  | -2 dB | $C_{tr(50-3150)} =$  | -7 dB |
| $R_w + C =$      | 38 dB | $C_{(50-5000)} =$  | -1 dB | $C_{tr(50-5000)} =$  | -7 dB |
| $R_w + C_{tr} =$ | 33 dB | $C_{(100-5000)} =$ | -1 dB | $C_{tr(100-5000)} =$ | -6 dB |

*Lee Grant-Riach*

Lee Grant-Riach  
Senior Technical Officer

\* indicates that the frequency is outside of our UKAS accreditation and is for information only

The legal validity of this report can only be claimed on presentation of the complete report

Report for: Duraflex Ltd  
Report Ref: BMT/MTP/F16125/01

6 / 14 / 8.8 (FLAT 4 (BED))



Laboratory measurement to  
BS EN ISO 10140-2 -  
Airborne Sound Insulation of



1762

|               |                             |
|---------------|-----------------------------|
| Sponsor:      | Duraflex Ltd                |
| Product Name  | Duraflex 70mm Diamond suite |
| Product Type  | Single casement window      |
| Material Type | PVC-U                       |
| Variations:   |                             |
| Glazing       | 6 / 14 / 8.8                |
| frame type    | 1                           |

*For detailed technical specification, please refer to Section 2 of the report*

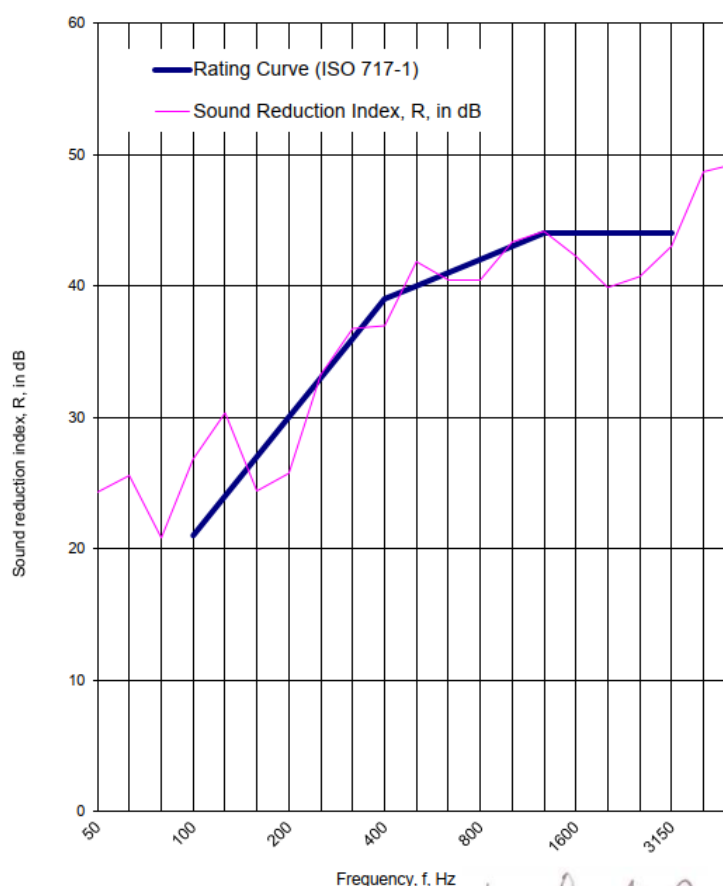
Data sheet Ref. MTP/F16125/01/P006  
Date of Test: 23/08/2016

Source Room Volume: 86.00 m<sup>3</sup>  
Receive Room Volume: 69.00 m<sup>3</sup>  
Specimen Installed By: Client  
Area of Specimen (S): 1.80 m<sup>2</sup>

Temp. in Test Rooms: Sour. 18.6 °C Rec. 18.7 °C  
Static Pressure: 95800.0 Pa 95850.0 Pa  
Humidity in Test Rooms: 52.3 % 51.6 %

| f, Hz | R, dB |
|-------|-------|
| 50*   | 24.3  |
| 63*   | 25.6  |
| 80*   | 20.8  |
| 100   | 26.8  |
| 125   | 30.3  |
| 160   | 24.4  |
| 200   | 25.7  |
| 250   | 33.2  |
| 315   | 36.8  |
| 400   | 37.0  |
| 500   | 41.8  |
| 630   | 40.5  |
| 800   | 40.5  |
| 1000  | 43.3  |
| 1250  | 44.2  |
| 1600  | 42.2  |
| 2000  | 39.9  |
| 2500  | 40.7  |
| 3150  | 43.0  |
| 4000  | 48.7  |
| 5000  | 49.3  |
| AAD   | -21.1 |

Frequency range for rating in accordance with ISO 717-1



|                        |                         |                            |
|------------------------|-------------------------|----------------------------|
| $R_w = 40$ dB          | $C_{(50-3150)} = -1$ dB | $C_{tr(50-3150)} = -5$ dB  |
| $R_w + C = 40$ dB      | $C_{(50-5000)} = 0$ dB  | $C_{tr(50-5000)} = -5$ dB  |
| $R_w + C_{tr} = 36$ dB | $C_{(100-5000)} = 0$ dB | $C_{tr(100-5000)} = -4$ dB |

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Report for: Duraflex Ltd  
Report Ref: BMT/MTP/F16125/01

## REPORT END