



# PEAK acoustics

## *Noise Assessment Report*

**Email:** [sales@acousticsurveys.co.uk](mailto:sales@acousticsurveys.co.uk) | **Office:** 0330 043 1764

**Web:** [www.acousticsurveys.co.uk](http://www.acousticsurveys.co.uk)

Peak Acoustics Ltd, Fernbank House, Springwood Way, Macclesfield, SK10 2XA



# Environmental Noise Assessment

Report Ref: NM1906206NR Rev 1.0

Issue Date: Friday 23<sup>rd</sup> October 2020

**Site: Land at Adderley Mill, Adderley, Cheadle, Stoke-on-Trent,  
Staffordshire, ST10 2NJ**

**Project Consultant**

N. Mitchell, BSc (Hons)

*Acoustic Consultant*

[nick@acousticsurveys.co.uk](mailto:nick@acousticsurveys.co.uk)

**Proofing Consultant**

K. Donald BSc (Hons) AMIOA

*Acoustic Consultant*

[kyle@acousticsurveys.co.uk](mailto:kyle@acousticsurveys.co.uk)



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## Revision History

| Rev. | Date       | Author | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------|------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0  | 08/10/2020 | NM     | First Issue Report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 1.0  | 22/10/2020 | NM     | <p>Amendments following superseded site plans and revised plot plans:</p> <ul style="list-style-type: none"><li>- Amendment to proposal; 4 no. plots.</li><li>- Amendment to Table 2 to reflect external noise levels</li><li>- Revised site plan; figure 1.</li><li>- Amendment to Section 4.4 – External Noise Levels.</li><li>- Addition/Amendment of Section 5 to assess proposed 1.8m brick wall.</li><li>- Amendment to Section 6 – 6.8 BS4142 Assessment.</li><li>- Amendment to Figure 3; site plan snippet.</li><li>- Revision of Appendices G &amp; H.</li></ul> |

## 1. Summary

### 1.1. Proposal

Demolition of existing buildings and erection of 4 no. residential dwellings is proposed at Adderley Mill, Adderley, Cheadle, Stoke-on-Trent, Staffordshire, ST10 2NJ.

This report amends and replaces a previous report for a 7-house development on the site written following the withdrawal of a planning application (Council ref: SMD/2019/0676). The present proposal, which is assessed in this report, is for the demolition of existing buildings and the erection of 4 no. residential dwellings at Adderley Mill, Adderley, Cheadle, Stoke-on-Trent, Staffordshire, ST10 2NJ. The revision history is set out on the previous page.

### 1.2. Reason for Assessment

The Local Authority has conditioned the requirement of a noise assessment to ensure desirable internal noise levels are met within habitable rooms of the proposed development. The assessment aims to provide a sound insulation scheme to ensure desirable internal noise levels are met and potential for adverse noise impact is minimised.

The assessment considers the following noise sources:

- Environmental noise; comprised of road traffic along the surrounding road network, and natural noise sources.
- Industrial noise: assessed to BS4142 criteria to identify the potential of adverse noise impacts.

### 1.3. Planning Conditions & Criteria

On the previous application for 7 houses on the site, Staffordshire Moorlands Council issued the following comments regarding noise:

“General Comments –

Noise: *There is no advice provided on the current noise environment and the suitability of housing for this site. It would be expected that a site-specific noise assessment is provided to support this application given the number of houses proposed and the current use of the adjacent site which is likely to have 24/7 permission to operate. Any noise assessment submitted should be conducted under BS4142:2014 and the suitability of housing for this site should be compliant with BS8233:2014.*

Recommendation - *Environmental Health recommend refusal of this application due to insufficient information being provided to address the noise concerns set out above.*

*Any approved noise scheme and measurements should pay due regard to British Standard BS8233: Sound insulation and noise reduction for buildings (Code of Practice), BS4142:2014 Methods for rating and assessing industrial or commercial sound and/or the Building Regulations 2010 Document E or other appropriate guidance.”*

## 1.4. Assessment Standards & Justification

**‘BS8233:2014 – Guidance on sound insulation and noise reduction for buildings’** is a recognised standard for assessing and mitigating environmental noise levels upon a proposed noise sensitive development. The standard gives a rigorous calculation method for determining interior noise levels based on measured environmental noise levels.

*Desirable internal noise levels are to be maintained as given in BS8233:2014:*

- *<35dB  $L_{Aeq, 16hr}$  within living areas during the day (07:00 – 23:00).*
- *<30dB  $L_{Aeq, 8hr}$  within bedrooms at night (23:00 – 07:00).*
- *45dB  $L_{AFmax}$  should not be regularly exceeded within bedrooms at night (23:00 – 07:00).*
- *50-55dB  $L_{Aeq, 16hr}$  within external amenity areas during the day (07:00 – 23:00).*

**‘World Health Organisation Guidelines for Community Noise (1999)’** details suitable noise levels for various activities within residential and commercial buildings

WHO Guidelines help to define the  $L_{AFmax}$  parameter requirements:

*“For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB  $L_{Amax}$  more than 10-15 times a night (Vallet & Vernet 1991)”.*

**‘BS4142:2014 – Methods for rating and assessing industrial and commercial sound’** - is a recognised standard for determining the noise impact of fixed plant machinery via relation of emissions to the measured background noise levels on site.

## 1.5. Environmental Noise Measurements

To assess environmental noise levels, a noise survey was undertaken at the site from Thursday 24<sup>th</sup> – Friday 25<sup>th</sup> September 2020. The results from these measurements are tabulated below.

Table 1. – Environmental Measurement Summary

| Measurement*                                           | Date(s)                                       | Period                       | $L_{Aeq}$ (dB) | Typical $L_{AFmax}$ (dB) |
|--------------------------------------------------------|-----------------------------------------------|------------------------------|----------------|--------------------------|
| M1<br>(Northern Boundary, overlooking industrial site) | 24 <sup>th</sup> & 25 <sup>th</sup> Sept 2020 | Day (16hr Aggregate Periods) | 49.8           | -                        |
|                                                        | 24 <sup>th</sup> – 25 <sup>th</sup> Sept 2020 | Night (8hr)                  | 39.0           | 62.9                     |
| M2<br>(Southern Boundary, overlooking Trimpos)         | 24 <sup>th</sup> & 25 <sup>th</sup> Sept 2020 | Day (16hr Aggregate Periods) | 61.3           | -                        |
|                                                        | 24 <sup>th</sup> – 25 <sup>th</sup> Sept 2020 | Night (8hr)                  | 53.0           | 81.5                     |

\*Figure 2 on page 10 shows the position of Environmental Noise Monitoring Locations M1 and M2.

The full measured sound levels are shown graphically in **Appendix E**.

## 1.6. Noise Assessment Outcome

It is determined that by using mitigation as specified in section 1.7 for the building facades, the outcome summarised in the following table is achieved.

Table 2. – Noise Assessment Outcome

| Internal Space                      | Noise Parameter           | Internal Noise Level (dB) | Within Desirable Limit (BS8233) |
|-------------------------------------|---------------------------|---------------------------|---------------------------------|
| <i>Front Facing Façade (Zone 1)</i> |                           |                           |                                 |
| Living                              | Daytime $L_{Aeq, 16hr}$   | 31.7                      | Yes                             |
| Bedrooms                            | Night-time $L_{Aeq, 8hr}$ | 12.2                      | Yes                             |
| Bedrooms                            | Night-time $L_{AFmax}$    | 40.2                      | Yes                             |
| <i>Rear Facing Façade (Zone 2)</i>  |                           |                           |                                 |
| Living                              | Daytime $L_{Aeq, 16hr}$   | 23.2                      | Yes                             |
| Bedrooms                            | Night-time $L_{Aeq, 8hr}$ | 9.7                       | Yes                             |
| Bedrooms                            | Night-time $L_{AFmax}$    | 30.8                      | Yes                             |
| External Space                      | Noise Parameter           | External Noise Level (dB) | Within Desirable Limit (BS8233) |
| Plot 1 & 2                          | Daytime $L_{Aeq, 16hr}$   | 52.6 – 53.7               | Yes<br>(See Section 5)          |
| Plot 3 & 4                          | Daytime $L_{Aeq, 16hr}$   | 49.8                      | Yes<br>(See Section 4.4)        |

## 1.7. Mitigation Recommendations

### 1.7.1. Glazing & Ventilation Scheme

The recommended glazing and ventilation scheme for respective ‘Zones’ is given below.

Table 3. – Glazing and Ventilation Scheme

| Internal Space                      | Glazing                             |                       | Ventilation                                     |                                          |
|-------------------------------------|-------------------------------------|-----------------------|-------------------------------------------------|------------------------------------------|
|                                     | Minimum Performance $R_w (+C_{tr})$ | Example Specification | Minimum Performance $D_{ne, W, +C_{tr}} (Open)$ | Example Specification                    |
| <i>Front Facing Façade (Zone 1)</i> |                                     |                       |                                                 |                                          |
| Living                              | 30 (26)                             | 4 / 16 / 4mm          | 32                                              | Titon Trimvent XS13 4400EA               |
| Bedrooms                            | 34 (29)                             | 4 / 16 / 6mm          | 52                                              | Greenwood MA3051 Through Wall Ventilator |
| <i>Rear Facing Façade (Zone 2)</i>  |                                     |                       |                                                 |                                          |
| Living                              | 30 (26)                             | 4 / 16 / 4mm          | 32                                              | Titon Trimvent XS13 4400EA               |
| Bedrooms                            | 30 (26)                             | 4 / 16 / 4mm          | 32                                              | Titon Trimvent XS13 4400EA               |

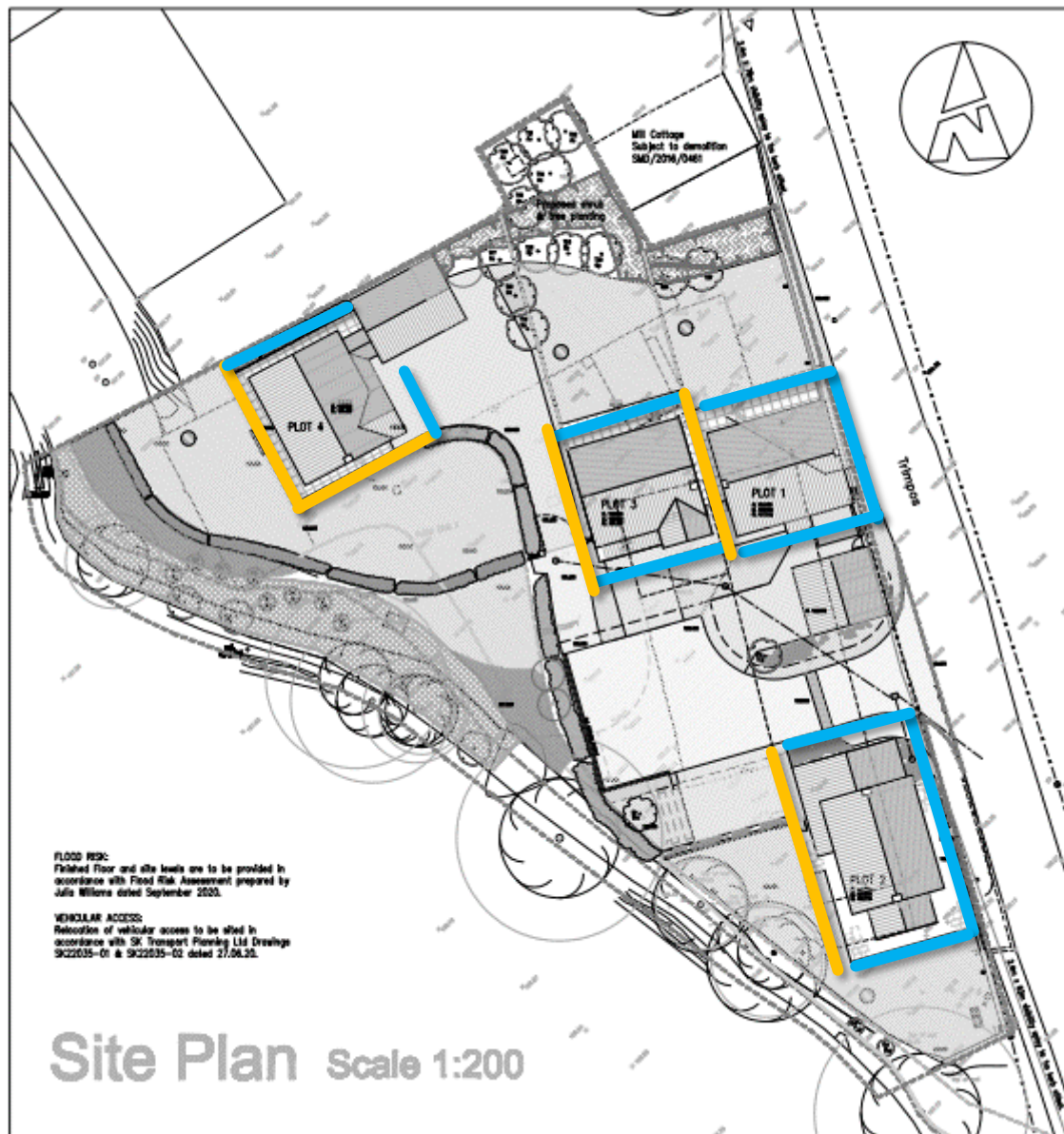
N.B: The sound insulation value of the glazing should take into account the glass as well as the frame and perimeter seal.

The specific designation of ‘zones’ is indicated below in Figure 1 and has been determined based on the differing noise exposure in these areas.

## 1.8. Zone Designation

*N.B: The indicated mitigation Zones apply to all floors.*

Figure 1. – Façade Mitigation Zone Designation



 - Zone 1 (Front Facing Façade)

 - Zone 2 (Rear Facing Façade)

## 1.9. Site & Measurement Location

The site is situated on the outskirts of Cheadle, Stoke, whereby farmland makes up much of the surrounding terrain. Immediately to the north is a light industrial works site and across the road to the east lies a similar business with observations of stationary HGV's within the compound area.

The site and measurement locations are shown on Figure 2 below.

Figure 2: Site & Measurement Locations – earth.google.com



- Unattended Environmental Monitoring Location (M1)
- Unattended Environmental Monitoring Location (M2)
- / Site Boundary (Approx.)

## 2. Environmental Noise Survey

### 2.1. Noise Source Investigation

A site-specific noise survey was undertaken at Adderley Mill to identify and assess both environmental noises, inclusive of road/air traffic and natural noise sources, along with any industrial/commercial noise which may have a negative impact on the proposed development.

Event recording was utilised during the survey to identify specific noise sources from the adjacent site.

At various periods throughout the day, noise from the adjacent site are audible; noise sources included HGV's idling within the compound, radio, conversing staff, occasional grinders being used within the main workshop and materials being dropped.

Event recording proved useful with no record of industrial/commercial noise during the evening and night-time periods. This is further justified within a decision notice for the adjacent site, in 2016; application ref: *SMD/2016/0461 – condition 7*.

*"Unless prior permission has been obtained in writing from the Local Planning Authority, all noisy activities shall be restricted to the following times of operation 08:00 – 18:00 hours (Monday to Friday); 08:00 – 13:00 hours (Saturday) and no working is permitted on Sundays or Bank Holidays. In this instance noisy activity is defined as any activity (for instance, but not restricted to, building construction/demolition operations, refurbishing and landscaping) which generates noise that is audible at the site boundary. Reason: - In the interests of residential amenity."*

Secondary noise sources included birdsong and occasional aeroplane flyover.

## 3. Survey Measurements

Day and night-time environmental noise measurements have been carried out over a 24-hour period from Thursday 24<sup>th</sup> – Friday 25<sup>th</sup> September 2020.

M1 - Measurements of  $L_{Aeq, T}$ ,  $L_{AFmax}$  and  $L_{90}$  were logged in 5-minute intervals using 1/3 octave resolution. Environmental noise measurements were conducted free-field at 2.0m from local ground-level, and >1m away from reflective surfaces.

M2 - Measurements of  $L_{Aeq, T}$ ,  $L_{AFmax}$  and  $L_{90}$  were logged in 5-minute intervals using 1/1 octave resolution. Environmental noise measurements were conducted free-field at 1.7m from ground-level, and >1m away from reflective surfaces.

### 3.1. Measurement Location

At position M1, the microphone was positioned above roof level of an existing single storey building, fully exposed to industrial/commercial activity to the north. Measurement M1 was shielded from the road due to existing buildings and therefore a secondary measurement M2 was undertaken to capture primary road traffic noise, and any other surrounding sources.

At position M2, the microphone was positioned at ground floor level, fully exposed to passing traffic and potential industrial/commercial activity across the road to the east.

### 3.2. Weather Conditions

Very light precipitation occurred overnight on 24<sup>th</sup> - 25<sup>th</sup> September, however wind speeds remained low with speeds of 3 – 6 m/s throughout the survey. Any noise level increase in the measured data from the precipitation can therefore be considered representative of worst-case scenario. Detailed meteorological information can be found in **Appendix C**.

### 3.3. Measurement Equipment

Measurement equipment complies with accuracy requirements for common environmental noise measurement standards. A detailed equipment list is given in **Appendix B** with calibration information in **Appendix D**.

### 3.4. Measured External Noise Levels

The measurement intervals from measurements M1 & M2 are summarised in the table below.

The full measured sound levels are shown graphically in **Appendix E**.

Table 4. – Measurement Results

| Measurement                                            | Date(s)                                       | Period                       | L <sub>Aeq</sub> (dB) | Typical L <sub>AFmax</sub> (dB) |
|--------------------------------------------------------|-----------------------------------------------|------------------------------|-----------------------|---------------------------------|
| M1<br>(Northern Boundary, overlooking industrial site) | 24 <sup>th</sup> & 25 <sup>th</sup> Sept 2020 | Day (16hr Aggregate Periods) | 49.8                  | -                               |
|                                                        | 24 <sup>th</sup> – 25 <sup>th</sup> Sept 2020 | Night (8hr)                  | 39.0                  | 62.9*                           |
| M2<br>(Southern Boundary, overlooking Trimpos)         | 24 <sup>th</sup> & 25 <sup>th</sup> Sept 2020 | Day (16hr Aggregate Periods) | 61.3                  | -                               |
|                                                        | 24 <sup>th</sup> – 25 <sup>th</sup> Sept 2020 | Night (8hr)                  | 53.0                  | 81.5*                           |

*\*The selected L<sub>AFmax</sub> corrected noise level spectra, is an average of the spectra of the noisiest 10 events of the night-time period; the maxima levels selected would not ordinarily be exceeded more than 10 times within the night-time, in accordance with the guidance.*

The application of noise data is detailed below:

M1 – Calculations of data to be applied to rear facing façades (shielded from primary noise sources).

M2 – Calculations of data to be applied to front facing façades (road exposure).

## 4. BS8233:2014 Environmental Noise Assessment

### 4.1. Criteria

Desirable internal noise levels are to be maintained as given in BS8233:2014:

- $<35\text{dB } L_{Aeq, 16hr}$  within living areas during the day (07:00 – 23:00).
- $<30\text{dB } L_{Aeq, 8hr}$  within bedrooms at night (23:00 – 07:00).
- $45\text{dB } L_{AFmax}$  should not be regularly exceeded within bedrooms at night (23:00 – 07:00).
- $50\text{--}55\text{dB } L_{Aeq, 16hr}$  within external amenity areas during the day (07:00 – 23:00).

WHO Guidelines help to define the  $L_{AFmax}$  parameter requirements:

*“For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately  $45\text{dB } L_{Amax}$  more than 10-15 times a night (Vallet & Vernet 1991)”.*

### 4.2. Internal Noise Levels – Proposed Insulation

Room dimensions and glazed areas have been approximated based on the drawings supplied to Peak Acoustics and drawn by ‘MAC Architectural Design Ltd’ with a drawing reference ‘1487-03’. Note that assessment is not required for each individual room. The selection of habitable rooms has been chosen as representative of the most noise sensitive areas, which have been selected on account of room and windows sizes. Construction details and calculations are provided within **Appendix F**.

### 4.3. Assessment Outcome – Internal Noise Levels

Internal noise levels have been calculated to demonstrate that the proposed residential dwellings can achieve suitable noise levels inside habitable rooms when appropriate glazing and ventilation systems are used. The recommended mitigation and corresponding internal noise levels are summarised in table 5 below.

Table 5. – Assessment Outcome

| Internal Space              | Glazing<br>Minimum Performance<br>$R_w (+C_{tr})$ | Ventilation<br><i>Minimum Performance</i><br>$D_{ne, W, +C_{tr}}$ (Open) | Internal Noise Level,<br>dB |
|-----------------------------|---------------------------------------------------|--------------------------------------------------------------------------|-----------------------------|
| Front Facing Rooms (Zone 1) |                                                   |                                                                          |                             |
| Living                      | 30 (26)                                           | 32                                                                       | 32 $L_{Aeq, 16hr}$          |
| Bedrooms                    | 30 (26)                                           | 32                                                                       | 12 $L_{Aeq, 8hr}$           |
|                             |                                                   |                                                                          | 40 $L_{AFmax}$              |
| Rear Facing Rooms (Zone 2)  |                                                   |                                                                          |                             |
| Living                      | 30 (26)                                           | 32                                                                       | 23 $L_{Aeq, 16hr}$          |
| Bedrooms                    | 30 (26)                                           | 32                                                                       | 10 $L_{Aeq, 8hr}$           |
|                             |                                                   |                                                                          | 31 $L_{AFmax}$              |

N.B: The sound insulation value of the glazing should consider the glass as well as the frame and perimeter seal.

For the daytime assessment for living areas, the desirable limit of BS8233:2014 suggests a guideline of  $35 \text{ dB } L_{Aeq, 16hr}$  for resting conditions, and up to  $40 \text{ dB}$  is considered acceptable for necessary developments.

All results, with the proposed construction, would place the internal levels in kitchen/living areas as below 35 dB, therefore within the desirable category.

For the night-time assessment for bedrooms, BS8233:2014 suggests a desirable guideline of 30 dB  $L_{Aeq, 8hr}$  for sleeping conditions, with an acceptable limit of 35 dB  $L_{Aeq, 8hr}$ . Individual noise events (Measured with fast time-weighted Maximum) should not normally exceed 45 dB  $L_{AFmax}$  (as in BS8233:1999).

The proposed construction would place the internal continuous levels in bedrooms as below 30 dB and the maximum noise events as typically below 45 dB  $L_{AFmax}$ , therefore within the desirable category.

#### 4.4. External Noise Levels – Assessment Results

BS8233:2014 provides a desirable guideline of 50 dB  $L_{Aeq, 16hr}$  for external amenity spaces and an acceptable guideline of 55 dB  $L_{Aeq, 16hr}$  for noisier environments.

External daytime noise levels from measurement M1 and M2 without attenuation provided by the proposed fencing is as follows:

Table 6. – External Noise Level Assessment Outcome

| Measurement | $L_{Aeq, 16-hour}$ |
|-------------|--------------------|
| M1          | 49.8               |
| M2          | 61.3               |

Plot layout plans provided by the client helped identify all plots include a private external garden area. Certain areas around site are proposed to feature portions of acoustic fencing, separating timber fencing as well as both stone and brick walling.

**Plot 1 & 2** external amenity area is located adjacent to Trimpos, fully exposed to road traffic noise. Once built, noise data from measurement M2 would reflect external amenity and therefore mitigation is required to ensure desirable external noise levels can be met.

It is proposed to install a 1.8m brick wall to separate plots 1 & 2 from road traffic. The assessment of attenuation provided by the proposed brick walling is detailed in Section 5 below.

**Plots 3 & 4** are set further back within site. It can be considered that once the dwellings are erected, noise levels would reflect that of measurement M1, conforming to desirable external daytime noise levels and therefore no mitigation against road traffic is deemed necessary. However, the adjacent light industrial site lies adjacent to the amenity areas of both plots 3 & 4 with potential for noise to become intrusive during levels of high activity.

It is proposed to install a 2.0m acoustic fence around the external garden boundary. Calculations of whether a 2.0m fence would sufficiently reduce noise from the adjacent light industrial works site. If required, further mitigation will be recommended to ensure external noise levels are within the desirable – acceptable noise limits. Further details are provided in Section 7.

## 5. Proposed 1.8m Brick Wall – Plots 1 & 2

### 5.1. Physical Mitigation – Boundary Treatment

It is only proposed to build a 1.8m brick wall along the road frontage of Plot 1, with a 900mm wall to be built along the road frontage of Plot 2. Due to external levels exceeding criteria within the amenity spaces for both Plot 1 & 2, it is therefore recommended to mitigate road traffic noise with installation of the proposed 1.8m brick wall. Attenuation provided by the proposed 1.8m brick wall will quantify if further mitigation is required. The recommended placement of brick walling is to be installed along sections of the south and eastern boundaries, detailed in **Appendix H**.

The barrier performance is determined based on the *Maekawa* Formula:

$$A_{\text{barrier}} = 10 \log(3 + 20N)$$

Where:

$$N \text{ (Fresnel Number)} = \frac{2\delta}{\lambda}$$

$$\delta = \text{Path Difference (a + b - c)}$$

Table 7: Road traffic mitigation measures

| Application        | Mitigate road traffic noise emissions                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Location           | As shown in <b>Appendix H</b>                                                                                                                                                                                                                                                             |
| Height             | 1.8 meters                                                                                                                                                                                                                                                                                |
| Construction       | Brick - approximately 220mm thickness (density around 2000 kg/m <sup>3</sup> )                                                                                                                                                                                                            |
| Other Requirements | <ul style="list-style-type: none"> <li>- Screening/Barriers should form a solid barrier with no gaps or fissures within the structure.</li> <li>- The separating barrier should be maintained in a good state of repair during the throughout the lifetime of the development.</li> </ul> |

Plot 1 - A barrier calculation has been performed which demonstrates that approximately **8.7 dB** attenuation is achievable using the proposed brick wall. Application of the above would result in a revised noise level of **52.6 dB**, compliant to BS8233 guidelines for the upper value limit of 55 dB L<sub>Aeq</sub>, 16hour.

Plot 2 - A barrier calculation has been performed which demonstrates that approximately **7.6 dB** attenuation is achievable using the proposed brick wall. Application of the above would result in a revised noise level of **53.7 dB**, compliant to BS8233 guidelines for the upper value limit of 55 dB L<sub>Aeq</sub>, 16hour.

It should be noted that the calculation has considered the centre of the road and receiver position being in the centre of the external garden space. For the barrier to be most effective, installation should be as near to the noise source as possible; in this case the brick wall is more effective if installed close to the road edge.

## 6. BS4142 Assessment Impact

### 6.1. Industrial/Commercial Noise Levels

During the site-specific noise survey undertaken at Adderley Mill site, the use of event recording was utilised to identify specific noise sources arising from the adjacent light industrial works site.

Noise data has been extracted from measurement M1 between 09:05-10:05 on 25<sup>th</sup> September. It was identified during a 1-hour period of daytime activity that noise from the adjacent site was audible. The specific Sound Level recorded at the boundary of site is detailed within Section 7.6.

### 6.2. Assessment Criteria

The assessment of plant noise emissions has been undertaken in accordance with BS4142:2014.

***‘BS4142:2014 – Methods for rating and assessing industrial and commercial sound’*** - is a recognised standard for determining the noise impact of fixed plant machinery via relation of emissions to the measured background noise levels on site.

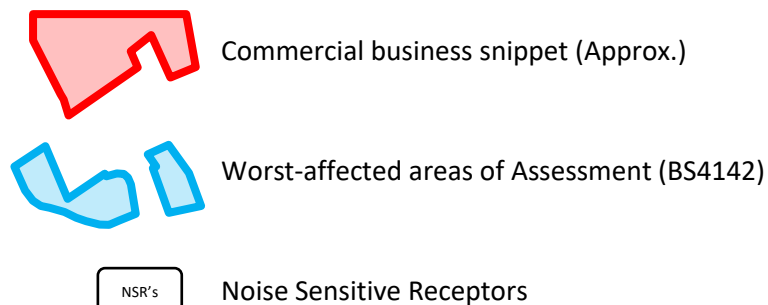
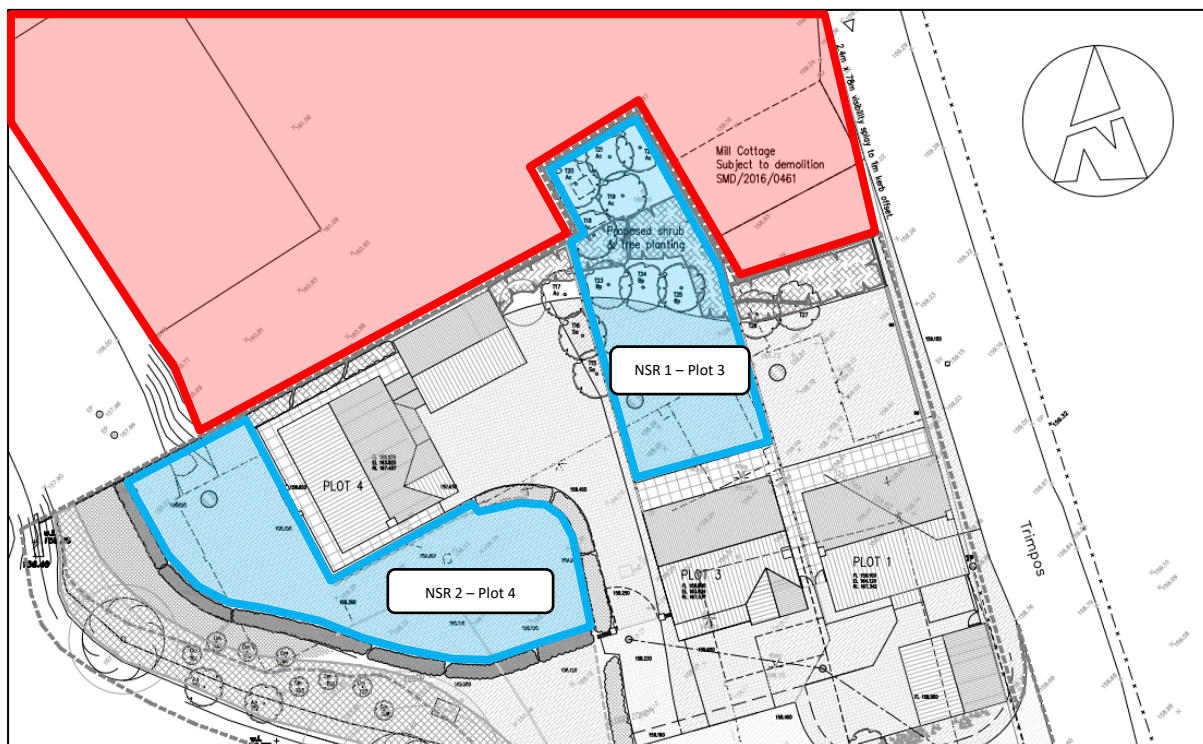
### 6.3. Noise Sensitive Receptors

The nearest or most-affected Noise Sensitive Receptor (NSR) has been identified as the nearest proposed plots that are in closest proximity to the commercial business. The identified receptors are shown in Figure 3 on page 16.

## 6.4. Proposed Residential Site, Existing Commercial Site & NSR Locations

The site, NSR and commercial business are shown in Figure 3 below:

Figure 3: Industrial/Commercial and Proposed Residential Site Snippet



## 6.5. Background Sound Levels

A typical background noise climate has been analysed from measurements M1, undertaken from 24<sup>th</sup> – 25<sup>th</sup> September 2020. As the commercial business is conditioned to operate between 08:00 – 18:00, the assessment considers a rolling 1-hour period between 07:00 – 19:00 which allow for a more robust assessment of sensitive time periods in the morning and evening.

The typical daytime background sound level derived from measurement M1 is 43 dB  $L_{A90, 1\text{hour}}$ . For the assessment of commercial / industrial noise arising from the adjacent commercial business, BS4142 states that “A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context”.

A cumulative Rating Level of **48 dB L<sub>Aeq, 1hour</sub>** is to not be exceeded to ensure adverse noise impacts are avoided.

Night-time noise impacts have not been assessed, reflective of the opening / closing times of the commercial business.

## 6.6. Specific Sound Level

A 1-hour boundary measurement was undertaken during a period of identified operation by the adjacent commercial business.

A list of the noise sources recorded are detailed below:

Table 8: Adjacent Commercial/Industrial Noise Sources

| Noise Source            | Location of Noise Source |
|-------------------------|--------------------------|
| Idling HGV              | Within site compound     |
| Conversing Staff        | Throughout site          |
| Grinder                 | Main workshop            |
| Radio                   | Assumed to run all day   |
| Materials being dropped | Throughout site          |

Measured levels were taken approximately 11.8m from the centre of the adjacent site. Commercial/Industrial noise levels were recorded at **56 dB L<sub>Aeq, 1hour</sub>**. Note that the Specific Sound Level is inclusive of other factors such as road traffic and can be considered worst-case. The calculation considers the centre of external garden areas as a representative receptor position.

Due to unpredictability of noise arising from different locations in the adjacent site, a line source distance correction has been applied to the noise data. The subsequent calculation derives a Specific Sound Levels at both Plots 3 & 4. The formula is as follows:

$$= 10 \log \left( \frac{r_1}{r_2} \right)$$

Where:

r1 = distance to source

r2 = distance to receptor

The Specific Sound Level predicted at Plot 3 is calculated at **55.3 dB L<sub>Aeq, 1hour</sub>**.

The Specific Sound Level predicted at Plot 4 is calculated at **51.0 dB L<sub>Aeq, 1hour</sub>**.

## 6.7. Rating Level

In accordance with BS4142:2014, the Specific Sound Levels may be corrected for characteristics that make the sound more noticeable at the NSR location such as tonality, impulsivity, and intermittency.

The analysis of noise emissions included a varying type of differing noise sources inclusive of impulsivity, intermittency, and tonal characteristics. Therefore, a penalty of + 6 dB has been applied to account for all three characteristics of noise.

The resultant Rating Level at NSR 1 is calculated at **61.3 dB L<sub>Ar</sub>**.

The resultant Rating Level at NSR 2 is calculated at **57.0 dB L<sub>Ar</sub>**.

## 6.8. Rating Level Vs Background Sound Level

The Rating Levels are to be compared to the measured background sound level to determine noise impact in accordance with BS4142:2014.

*A Sound Rating Level at or below the background noise level is indicative of Low Impact;*

*A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;*

*A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;*

The indicated noise impact at the identified Noise Sensitive Receptors is summarised below:

Table 9: Rating Levels

| NSR Location | Rating Level, dB L <sub>Ar</sub> | Background Sound Level, dB L <sub>A90 1 hour</sub> | Difference | Noise Impact        |
|--------------|----------------------------------|----------------------------------------------------|------------|---------------------|
| NSR 1        | 61.3                             | 43                                                 | + 18.3     | Significant Adverse |
| NSR 2        | 57.0                             | 43                                                 | + 14.0     | Adverse             |

Rating levels at NSR 1 exceed the background sound level by 18.3 dB, indicating the potential for significant adverse noise impacts. Mitigation is therefore recommended to reduce Rating Levels at both NSR locations, this is discussed in Section 6.

## 7. Mitigation against Commercial / Industrial Noise

### 7.1. Proposed Acoustic Fencing

Due to noise emanating from the adjacent site, it is not possible to attenuate noise at source. However, there are other practical means of mitigation which has the potential to be viable options to protect the development.

It is proposed to install acoustic fencing along the northern boundary which separates the two sites. The proposed fencing is of an acoustic quality grade (Jacksons – Jakoustic Fencing®) and has a proposed height of 2.0m.

Therefore, the assessment looks to calculate the noise impact with the proposed fencing and see whether the outcome meets criteria or whether further mitigation is required.

The performance of proposed acoustic fencing is determined based on the *Maekawa* Formula:

$$A_{\text{barrier}} = 10 \log(3 + 20N)$$

Where:

$$N \text{ (Fresnel Number)} = \frac{2\delta}{\lambda}$$

$$\delta = \text{Path Difference (a + b - c)}$$

With installation of a 2.0m acoustic fence, barrier attenuation is calculated at both NSR locations and detailed below:

Barrier attenuation provided at NSR1 is calculated at 9.3 dB.

Barrier attenuation provided at NSR2 is calculated at 6.8 dB.

The predicted level calculated at NSR1 is 52.0 dB, exceeding the background sound level by a factor of 9.0 dB indicative of adverse impact.

The predicted level calculated at NSR2 is 50.2 dB, exceeding the background sound level by a factor of 7.2 dB indicative of adverse impact.

Due to the exceedance upon background sound levels, it is recommended to enhance the acoustic fencing and provide further attenuation in the attempt of achieving a low impact in accordance with BS4142:2014.

## 7.2. Enhanced Boundary Mitigation - Acoustic Fencing

Due to predicted levels, along with penalties applied to account for the character of noise arising from the adjacent site, it is therefore recommended to install sections of acoustic fencing to form an acoustic barrier along the north boundary.

Table 10: BS4142 mitigation measures

| Application        | Mitigate road traffic noise emissions                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Location           | As shown in <b>Appendix H</b>                                                                                                                                                                                                                                              |
| Height             | 3.0 meters                                                                                                                                                                                                                                                                 |
| Construction       | Timber-type Acoustic Grade Fencing with a minimum surface density of <b>15kg/m<sup>2</sup></b> (an example of a manufacturer that produces such fencing is <i>Jacksons</i> ).                                                                                              |
| Other Requirements | <ul style="list-style-type: none"> <li>- Screening/Barriers should form a solid barrier with no gaps or fissures within the structure.</li> <li>- Fencing should be maintained in a good state of repair during the throughout the lifetime of the development.</li> </ul> |

With installation of a 3.0m acoustic fence, barrier attenuation is calculated at both NSR locations and detailed below:

Barrier attenuation provided at NSR1 is calculated at 14.4 dB.

Barrier attenuation provided at NSR2 is calculated at 12.1 dB.

The predicted level calculated at NSR1 is 46.9 dB, exceeding the background sound level by a factor of 3.9 dB conforming to achieve a low impact in accordance with BS4142:2014

The predicted level calculated at NSR2 is 45.0 dB, exceeding the background sound level by a factor of 2.0 dB conforming to achieve a low impact in accordance with BS4142:2014

Installation of the recommended mitigation would ensure a Low impact is achievable at both NSR locations. Please note that the recommended mitigating fence is to be installed along the whole northern boundary in the attempt to reduce potential noise levels across the proposed development, minimising adverse impact. Calculations are provided in **Appendix G**.

## 8. Conclusion

A noise assessment has been conducted for a proposed development of 4 no. residential dwellings at Adderley Mill, Adderley, Cheadle, Stoke-on-Trent, Staffordshire, ST10 2NJ. The development is situated in close proximity to a light industrial site to the north. The assessment was to ensure the future occupants do not suffer a loss of amenity due to noise and activity associated with the industrial site.

A noise survey was conducted at the site from Thursday 24<sup>th</sup> – Friday 25<sup>th</sup> September 2020 at the most exposed locations to both the industrial noise and road traffic noise.

To consider the character of the industrial noise climate at the site location, applied Rating Level penalties of BS4142 was deemed appropriate; a total of + 6 dB was applied to the Specific Sound Level to reflect the impact and character of light industrial noise.

A sound insulation scheme of glazing and ventilation has been given to ensure internal noise is controlled, and that future occupants of the proposed development do not suffer a loss of amenity.

Mitigating boundary treatment has been recommended to ensure external noise is controlled, and that future occupants do not suffer a loss of amenity due to activity associated with the nearby industrial site.

Provided the recommendations given within this report are implemented in full and adhered to, noise emissions associated with the proposal are to be controlled with the potential for adverse noise impacts minimised.

## APPENDIX A – Measurement Details

| Measurement(s) | Kit | Start Date | Start Time | End Date   | End Time |
|----------------|-----|------------|------------|------------|----------|
| <b>M1</b>      | A4  | 24/09/2020 | 11:00      | 25/09/2020 | 11:00    |
| <b>M2</b>      | A1  | 24/09/2020 | 11:45      | 25/09/2020 | 11:45    |

## APPENDIX B – Equipment Details

| Kit        | Equipment   | Make             | Model | Class | Serial Number |
|------------|-------------|------------------|-------|-------|---------------|
| <b>A4</b>  | Sound Meter | Svantek          | 971   | 1     | 60688         |
| <b>A4</b>  | Pre-Amp     | Svantek          | SV18  | 1     | 62781         |
| <b>A4</b>  | Microphone  | ACO              | 7052E | 1     | 66703         |
| <b>A1</b>  | Sound Meter | Svantek          | 958   | 1     | 34525         |
| <b>A1</b>  | Pre-Amp     | Svantek          | SV12L | 1     | 32484         |
| <b>A1</b>  | Microphone  | Microtech Gefell | MK255 | 1     | 11561         |
| <b>Cal</b> | Calibrator  | Svantek          | SV33A | 1     | 90273         |

## APPENDIX C – Meteorology Details

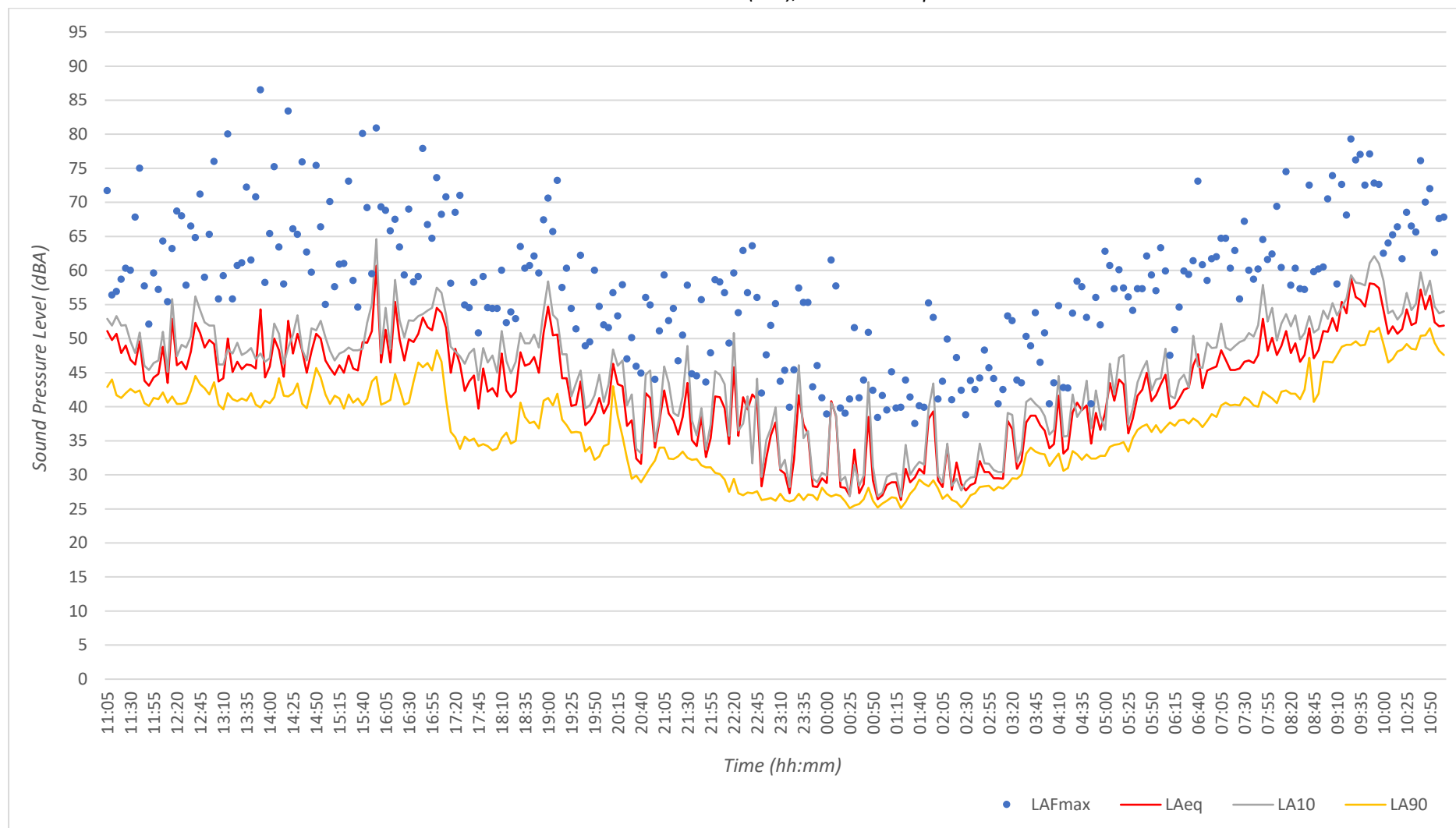
| Date                                 | Temp C° | Wind Speed<br>m/s | Wind<br>Direction | Humidity % | Precipitation<br>mm | Cloud Cover<br>(Oktas) |
|--------------------------------------|---------|-------------------|-------------------|------------|---------------------|------------------------|
| <b>24/09/20</b><br>(Start of Survey) | 21      | 2                 | S                 | 82         | 0.0                 | 3/8                    |
| <b>25/09/20</b><br>(End of Survey)   | 22      | 2 – 3             | SW                | 81         | 1.0                 | 7/8                    |

## APPENDIX D – Calibration Details

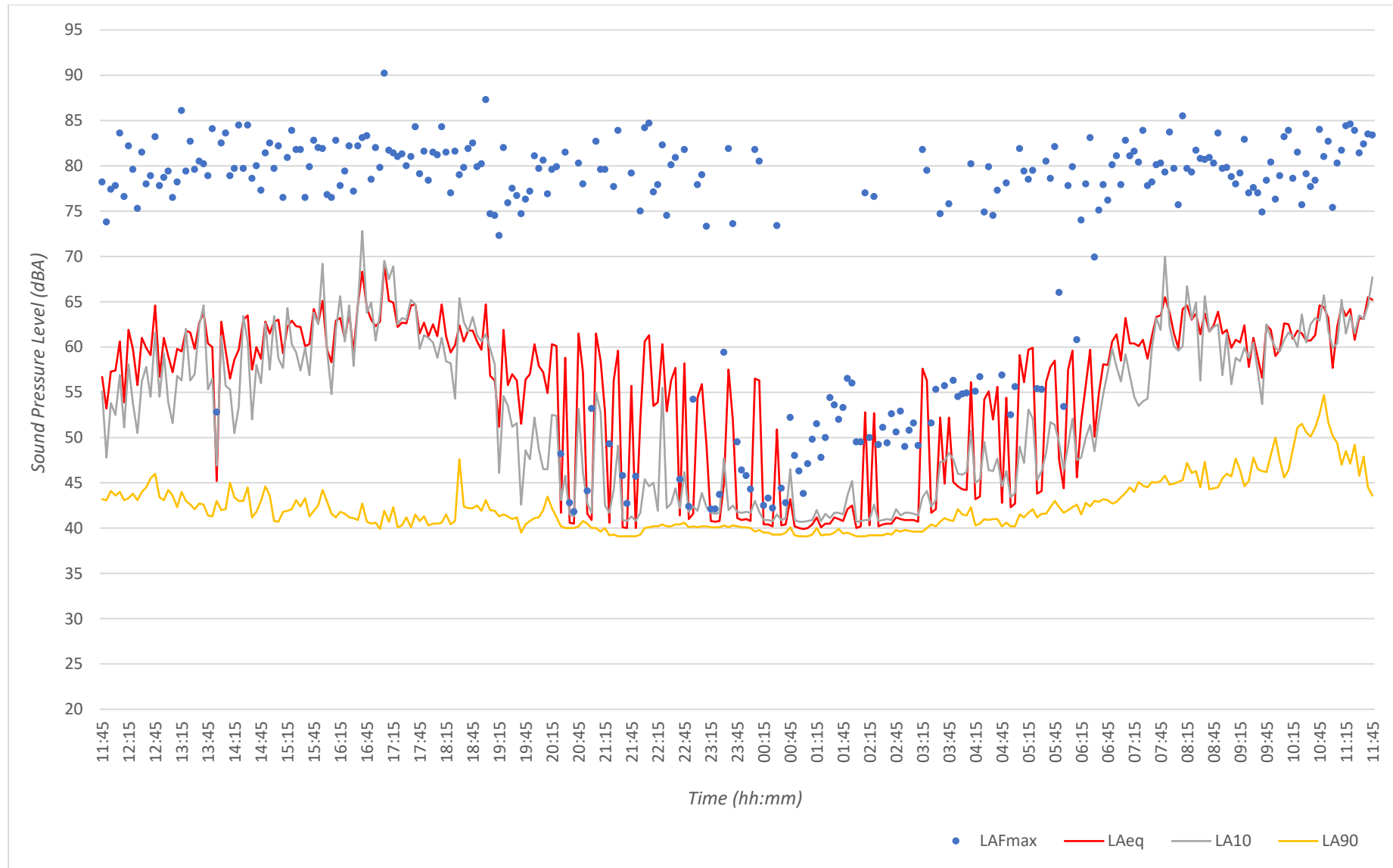
| Kit       | Calibrator Ref Level (dB) | Deviation Before (dB) | Deviation After (dB) |
|-----------|---------------------------|-----------------------|----------------------|
| <b>A4</b> | 113.9                     | -1.0                  | -0.8                 |
| <b>A1</b> | 114.0                     | 0.1                   | -0.1                 |

## APPENDIX E – Noise Survey Results

Environmental Noise Measurement (M1), 24<sup>th</sup> – 25<sup>th</sup> September 2020



Environmental Noise Measurement (M2), 24<sup>th</sup> – 25<sup>th</sup> September 2020

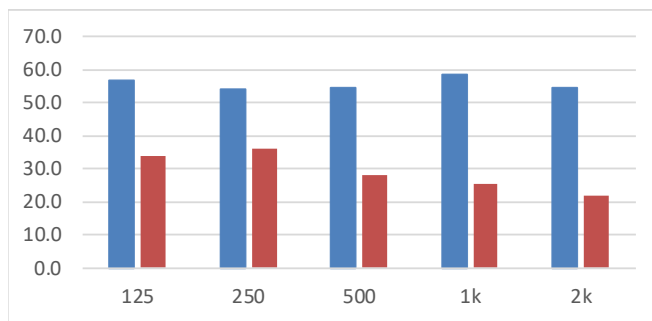


## APPENDIX F – BS8233 Rigorous Design Calculations

### Zone 1 - Living/Kitchen (Daytime LAeq: 07:00 - 23:00)

| Room Properties               |                                     | Sound Insulation Properties    |     |     |     |    |    |
|-------------------------------|-------------------------------------|--------------------------------|-----|-----|-----|----|----|
| Room Width (m)                | 3.7                                 | Freq. Hz                       | 125 | 250 | 500 | 1k | 2k |
| Room Depth (m)                | 5.2                                 | Wall, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Room Height (m)               | 2.4                                 | Roof, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Glazed Area (m <sup>2</sup> ) | 6.3                                 | Glazing, dB R <sub>w+Ctr</sub> | 24  | 18  | 26  | 40 | 45 |
| Is dwelling within roof?      | <input checked="" type="checkbox"/> | Vents, D <sub>n,e,w+Ctr</sub>  | 34  | 27  | 37  | 35 | 34 |

Noise Levels, dB



|                |              |
|----------------|--------------|
| External Level | 63.1 dB LAeq |
| Internal Level | 31.7 dB LAeq |
| Insertion Loss | 31.4 dB LAeq |

#### Sound Insulation Requirement

| Minimum Sound Insulation Requirement |               |                         | Suitable Systems                                                      |
|--------------------------------------|---------------|-------------------------|-----------------------------------------------------------------------|
| Glazing                              | <b>30(26)</b> | dB R <sub>w(+Ctr)</sub> | Double Glazing<br><a href="#">4 / 16 / 4</a>                          |
| Ventilation                          | <b>32</b>     | D <sub>n,e,w+Ctr</sub>  | Hit & miss trickle vent<br><a href="#">Titon Trimvent XS13 4400EA</a> |

*Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.*

#### Technical Calculations

| Frequency, Hz                | 125       | 250     | 500     | 1k      | 2k       |
|------------------------------|-----------|---------|---------|---------|----------|
| Term 1                       | 0.0004545 | 0.00228 | 0.00023 | 0.00036 | 0.000454 |
| Term 2                       | 0.0028426 | 0.01132 | 0.00179 | 7.1E-05 | 2.26E-05 |
| Term 3                       | 2.271E-05 | 9E-06   | 9E-06   | 1.1E-06 | 4.53E-07 |
| Term 4                       | 0         | 0       | 0       | 0       | 0        |
| Internal, dB L <sub>eq</sub> | 34.0      | 36.1    | 27.9    | 25.4    | 22.1     |
| Internal, dB LAeq            | 17.9      | 27.5    | 24.7    | 25.4    | 23.3     |

#### Façade Components

|         |                              |
|---------|------------------------------|
| Wall    | Brick and block, 75mm cavity |
| Roof    | Not Within Roof Space        |
| Glazing | Double Glazing               |
| Vents   | Hit & miss trickle vent      |

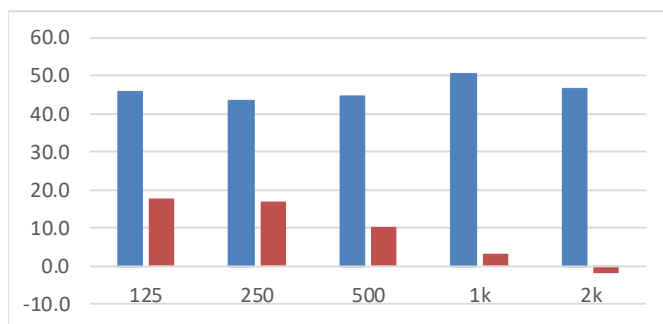
Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left( \frac{A_0}{S} 10^{\frac{-D_{st}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{\pi}}{S} 10^{\frac{-R_{\pi}}{10}} \right) + 10 \log_{10} \left( \frac{S}{A} \right) + 3$$

## Zone 1 - Bedroom (Night-Time LAeq: 23:00 - 07:00)

| Room Properties               |                                     | Sound Insulation Properties    |      |      |     |      |      |
|-------------------------------|-------------------------------------|--------------------------------|------|------|-----|------|------|
| Room Width (m)                | 3.6                                 | Freq. Hz                       | 125  | 250  | 500 | 1k   | 2k   |
| Room Depth (m)                | 5.8                                 | Wall, dB R <sub>w+Ctr</sub>    | 41   | 45   | 45  | 54   | 58   |
| Room Height (m)               | 2.4                                 | Roof, dB R <sub>w+Ctr</sub>    | 41   | 45   | 45  | 54   | 58   |
| Glazed Area (m <sup>2</sup> ) | 2.0                                 | Glazing, dB R <sub>w+Ctr</sub> | 24   | 21   | 29  | 43   | 43   |
| Is dwelling within roof?      | <input checked="" type="checkbox"/> | Vents, D <sub>n,e,w+Ctr</sub>  | 46.7 | 46.3 | 49  | 55.7 | 66.3 |

### Noise Levels, dB



|                |              |
|----------------|--------------|
| External Level | 53.0 dB LAeq |
| Internal Level | 12.2 dB LAeq |
| Insertion Loss | 40.8 dB LAeq |

### Sound Insulation Requirement

| Minimum Sound Insulation Requirement |               |                         | Suitable Systems                                           |
|--------------------------------------|---------------|-------------------------|------------------------------------------------------------|
| Glazing                              | <b>34(29)</b> | dB R <sub>w(+Ctr)</sub> | Double Glazing<br><a href="#">4 / 16 / 6</a>               |
| Ventilation                          | <b>52</b>     | D <sub>n,e,w+Ctr</sub>  | Passive thru-wall vent<br><a href="#">Greenwood MA3051</a> |

*Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.*

### Technical Calculations

| Frequency, Hz                | 125       | 250     | 500     | 1k      | 2k       |
|------------------------------|-----------|---------|---------|---------|----------|
| Term 1                       | 2.474E-05 | 2.7E-05 | 1.5E-05 | 3.1E-06 | 2.71E-07 |
| Term 2                       | 0.0009146 | 0.00182 | 0.00029 | 1.2E-05 | 1.15E-05 |
| Term 3                       | 6.118E-05 | 2.4E-05 | 2.4E-05 | 3.1E-06 | 1.22E-06 |
| Term 4                       | 0         | 0       | 0       | 0       | 0        |
| Internal, dB L <sub>eq</sub> | 17.7      | 17.1    | 10.3    | 3.3     | -1.8     |
| Internal, dB LAeq            | 1.6       | 8.5     | 7.1     | 3.3     | -0.6     |

### Façade Components

|         |                              |
|---------|------------------------------|
| Wall    | Brick and block, 75mm cavity |
| Roof    | Not Within Roof Space        |
| Glazing | Double Glazing               |
| Vents   | Passive thru-wall vent       |

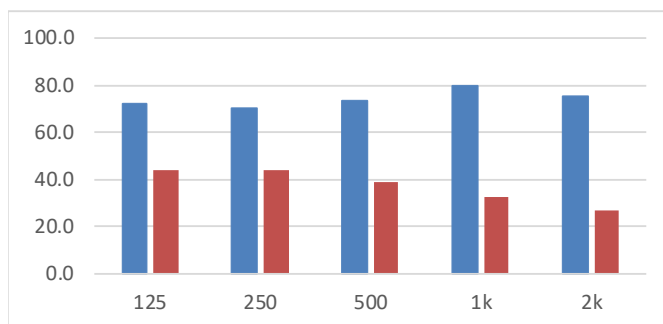
Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left( \frac{A_0}{S} 10^{\frac{-D_{0,2}}{10}} + \frac{S_{wl}}{S} 10^{\frac{-R_{wl}}{10}} + \frac{S_{fw}}{S} 10^{\frac{-R_{fw}}{10}} + \frac{S_{n}}{S} 10^{\frac{-R_n}{10}} \right) + 10 \log_{10} \left( \frac{S}{A} \right) + 3$$

## Zone 1 - Bedrooms (Night LAmax)

| Room Properties               |                                     | Sound Insulation Properties    |      |      |     |      |      |
|-------------------------------|-------------------------------------|--------------------------------|------|------|-----|------|------|
| Room Width (m)                | 3.6                                 | Freq. Hz                       | 125  | 250  | 500 | 1k   | 2k   |
| Room Depth (m)                | 5.8                                 | Wall, dB R <sub>w+Ctr</sub>    | 41   | 45   | 45  | 54   | 58   |
| Room Height (m)               | 2.4                                 | Roof, dB R <sub>w+Ctr</sub>    | 41   | 45   | 45  | 54   | 58   |
| Glazed Area (m <sup>2</sup> ) | 2.0                                 | Glazing, dB R <sub>w+Ctr</sub> | 24   | 21   | 29  | 43   | 43   |
| Is dwelling within roof?      | <input checked="" type="checkbox"/> | Vents, D <sub>n,e,w+Ctr</sub>  | 46.7 | 46.3 | 49  | 55.7 | 66.3 |

### Noise Levels, dB



|                |               |
|----------------|---------------|
| External Level | 81.5 dB LAmax |
| Internal Level | 40.2 dB LAmax |
| Insertion Loss | 41.3 dB LAmax |

### Sound Insulation Requirement

| Minimum Sound Insulation Requirement |               |                         | Suitable Systems                                           |
|--------------------------------------|---------------|-------------------------|------------------------------------------------------------|
| Glazing                              | <b>34(29)</b> | dB R <sub>w(+Ctr)</sub> | Double Glazing<br><a href="#">4 / 16 / 6</a>               |
| Ventilation                          | <b>52</b>     | D <sub>n,e,w+Ctr</sub>  | Passive thru-wall vent<br><a href="#">Greenwood MA3051</a> |

*Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.*

### Technical Calculations

| Frequency, Hz                | 125       | 250     | 500     | 1k      | 2k       |
|------------------------------|-----------|---------|---------|---------|----------|
| Term 1                       | 2.474E-05 | 2.7E-05 | 1.5E-05 | 3.1E-06 | 2.71E-07 |
| Term 2                       | 0.0009146 | 0.00182 | 0.00029 | 1.2E-05 | 1.15E-05 |
| Term 3                       | 6.118E-05 | 2.4E-05 | 2.4E-05 | 3.1E-06 | 1.22E-06 |
| Term 4                       | 0         | 0       | 0       | 0       | 0        |
| Internal, dB L <sub>eq</sub> | 43.9      | 44.1    | 38.9    | 32.8    | 26.9     |
| Internal, dB LAeq            | 27.8      | 35.5    | 35.7    | 32.8    | 28.1     |

### Façade Components

|         |                              |
|---------|------------------------------|
| Wall    | Brick and block, 75mm cavity |
| Roof    | Not Within Roof Space        |
| Glazing | Double Glazing               |
| Vents   | Passive thru-wall vent       |

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left( \frac{A_0}{S} 10^{\frac{-D_{as}}{10}} + \frac{S_{wl}}{S} 10^{\frac{-R_{wl}}{10}} + \frac{S_{rw}}{S} 10^{\frac{-R_{rw}}{10}} + \frac{S_{n}}{S} 10^{\frac{-R_{n}}{10}} \right) + 10 \log_{10} \left( \frac{S}{A} \right) + 3$$

## Zone 2 - Living/Kitchen (Daytime LAeq: 07:00 - 23:00)

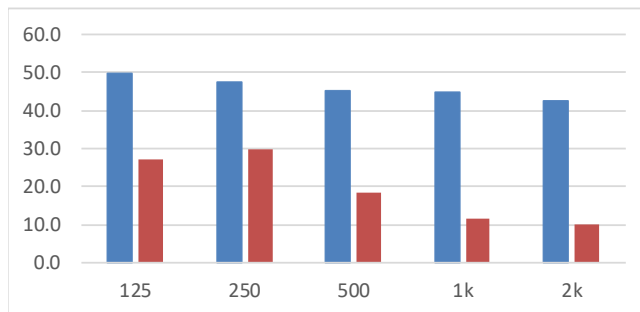
### Room Properties

|                               |                                     |
|-------------------------------|-------------------------------------|
| Room Width (m)                | 3.7                                 |
| Room Depth (m)                | 5.2                                 |
| Room Height (m)               | 2.4                                 |
| Glazed Area (m <sup>2</sup> ) | 6.3                                 |
| Is dwelling within roof?      | <input checked="" type="checkbox"/> |

### Sound Insulation Properties

|                                |     |     |     |    |    |
|--------------------------------|-----|-----|-----|----|----|
| Freq. Hz                       | 125 | 250 | 500 | 1k | 2k |
| Wall, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Roof, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Glazing, dB R <sub>w+Ctr</sub> | 24  | 18  | 26  | 40 | 45 |
| Vents, D <sub>n,e,w+Ctr</sub>  | 34  | 27  | 37  | 35 | 34 |

### Noise Levels, dB



|                |              |
|----------------|--------------|
| External Level | 49.8 dB LAeq |
| Internal Level | 23.2 dB LAeq |
| Insertion Loss | 26.6 dB LAeq |

### Sound Insulation Requirement

|             | Minimum Sound Insulation Requirement |                         | Suitable Systems                                                      |
|-------------|--------------------------------------|-------------------------|-----------------------------------------------------------------------|
| Glazing     | <b>30(26)</b>                        | dB R <sub>w(+Ctr)</sub> | Double Glazing<br><a href="#">4 / 16 / 4</a>                          |
| Ventilation | <b>32</b>                            | D <sub>n,e,w+Ctr</sub>  | Hit & miss trickle vent<br><a href="#">Titon Trimvent XS13 4400EA</a> |

*Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.*

### Technical Calculations

|                              |           |         |         |         |          |
|------------------------------|-----------|---------|---------|---------|----------|
| Frequency, Hz                | 125       | 250     | 500     | 1k      | 2k       |
| Term 1                       | 0.0004545 | 0.00228 | 0.00023 | 0.00036 | 0.000454 |
| Term 2                       | 0.0028426 | 0.01132 | 0.00179 | 7.1E-05 | 2.26E-05 |
| Term 3                       | 2.271E-05 | 9E-06   | 9E-06   | 1.1E-06 | 4.53E-07 |
| Term 4                       | 0         | 0       | 0       | 0       | 0        |
| Internal, dB L <sub>eq</sub> | 27.0      | 29.9    | 18.4    | 11.7    | 10.0     |
| Internal, dB LAeq            | 10.9      | 21.3    | 15.2    | 11.7    | 11.2     |

### Façade Components

|         |                              |
|---------|------------------------------|
| Wall    | Brick and block, 75mm cavity |
| Roof    | Not Within Roof Space        |
| Glazing | Double Glazing               |
| Vents   | Hit & miss trickle vent      |

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left( \frac{A_0}{S} 10^{\frac{-D_{0a}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{w1}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{w2}}{10}} + \frac{S_{v1}}{S} 10^{\frac{-R_{v1}}{10}} \right) + 10 \log_{10} \left( \frac{S}{A} \right) + 3$$

## Zone 2 - Bedroom (Night-Time LAeq: 23:00 - 07:00)

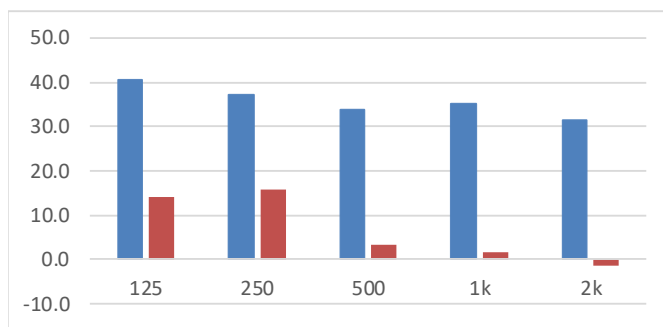
### Room Properties

|                               |                                     |
|-------------------------------|-------------------------------------|
| Room Width (m)                | 3.6                                 |
| Room Depth (m)                | 5.8                                 |
| Room Height (m)               | 2.4                                 |
| Glazed Area (m <sup>2</sup> ) | 2.0                                 |
| Is dwelling within roof?      | <input checked="" type="checkbox"/> |

### Sound Insulation Properties

| Freq. Hz                       | 125 | 250 | 500 | 1k | 2k |
|--------------------------------|-----|-----|-----|----|----|
| Wall, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Roof, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Glazing, dB R <sub>w+Ctr</sub> | 24  | 18  | 26  | 40 | 45 |
| Vents, D <sub>n,e,w+Ctr</sub>  | 34  | 27  | 37  | 35 | 34 |

### Noise Levels, dB



|                |              |
|----------------|--------------|
| External Level | 39.0 dB LAeq |
| Internal Level | 9.7 dB LAeq  |
| Insertion Loss | 29.3 dB LAeq |

### Sound Insulation Requirement

| Minimum Sound Insulation Requirement |               |                         | Suitable Systems                                                      |
|--------------------------------------|---------------|-------------------------|-----------------------------------------------------------------------|
| Glazing                              | <b>30(26)</b> | dB R <sub>w(+Ctr)</sub> | Double Glazing<br><a href="#">4 / 16 / 4</a>                          |
| Ventilation                          | <b>32</b>     | D <sub>n,e,w+Ctr</sub>  | Hit & miss trickle vent<br><a href="#">Titon Trimvent XS13 4400EA</a> |

*Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.*

### Technical Calculations

| Frequency, Hz                | 125       | 250     | 500     | 1k      | 2k       |
|------------------------------|-----------|---------|---------|---------|----------|
| Term 1                       | 0.0004608 | 0.00231 | 0.00023 | 0.00037 | 0.000461 |
| Term 2                       | 0.0009146 | 0.00364 | 0.00058 | 2.3E-05 | 7.27E-06 |
| Term 3                       | 6.118E-05 | 2.4E-05 | 2.4E-05 | 3.1E-06 | 1.22E-06 |
| Term 4                       | 0         | 0       | 0       | 0       | 0        |
| Internal, dB L <sub>eq</sub> | 14.0      | 15.9    | 3.3     | 1.5     | -1.3     |
| Internal, dB LAeq            | -2.1      | 7.3     | 0.1     | 1.5     | -0.1     |

### Façade Components

|         |                              |
|---------|------------------------------|
| Wall    | Brick and block, 75mm cavity |
| Roof    | Not Within Roof Space        |
| Glazing | Double Glazing               |
| Vents   | Hit & miss trickle vent      |

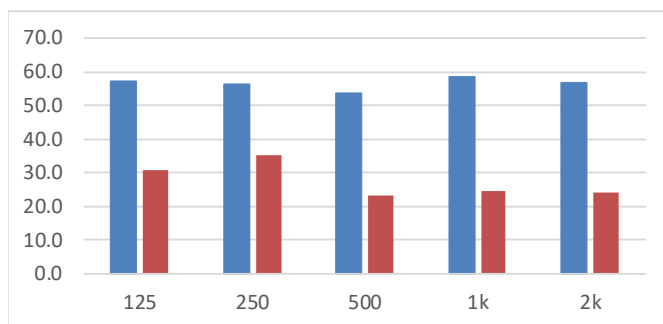
Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left( \frac{A_0}{S} 10^{\frac{-D_{0,2}}{10}} + \frac{S_{wl}}{S} 10^{\frac{-R_{wl}}{10}} + \frac{S_{fw}}{S} 10^{\frac{-R_{fw}}{10}} + \frac{S_{n}}{S} 10^{\frac{-R_n}{10}} \right) + 10 \log_{10} \left( \frac{S}{A} \right) + 3$$

## Zone 2 - Bedrooms (Night L<sub>Amax</sub>)

| Room Properties               |                                     | Sound Insulation Properties    |     |     |     |    |    |
|-------------------------------|-------------------------------------|--------------------------------|-----|-----|-----|----|----|
| Room Width (m)                | 3.6                                 | Freq. Hz                       | 125 | 250 | 500 | 1k | 2k |
| Room Depth (m)                | 5.8                                 | Wall, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Room Height (m)               | 2.4                                 | Roof, dB R <sub>w+Ctr</sub>    | 41  | 45  | 45  | 54 | 58 |
| Glazed Area (m <sup>2</sup> ) | 2.0                                 | Glazing, dB R <sub>w+Ctr</sub> | 24  | 18  | 26  | 40 | 45 |
| Is dwelling within roof?      | <input checked="" type="checkbox"/> | Vents, D <sub>n,e,w+Ctr</sub>  | 34  | 27  | 37  | 35 | 34 |

### Noise Levels, dB



|                |                           |
|----------------|---------------------------|
| External Level | 62.9 dB L <sub>Amax</sub> |
| Internal Level | 30.8 dB L <sub>Amax</sub> |
| Insertion Loss | 32.1 dB L <sub>Amax</sub> |

### Sound Insulation Requirement

| Minimum Sound Insulation Requirement |               |                         | Suitable Systems                                             |
|--------------------------------------|---------------|-------------------------|--------------------------------------------------------------|
| Glazing                              | <b>30(26)</b> | dB R <sub>w(+Ctr)</sub> | Double Glazing<br><i>4 / 16 / 4</i>                          |
| Ventilation                          | <b>32</b>     | D <sub>n,e,w+Ctr</sub>  | Hit & miss trickle vent<br><i>Titon Trimvent XS13 4400EA</i> |

*Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.*

### Technical Calculations

| Frequency, Hz                 | 125       | 250     | 500     | 1k      | 2k       |
|-------------------------------|-----------|---------|---------|---------|----------|
| Term 1                        | 0.0004608 | 0.00231 | 0.00023 | 0.00037 | 0.000461 |
| Term 2                        | 0.0009146 | 0.00364 | 0.00058 | 2.3E-05 | 7.27E-06 |
| Term 3                        | 6.118E-05 | 2.4E-05 | 2.4E-05 | 3.1E-06 | 1.22E-06 |
| Term 4                        | 0         | 0       | 0       | 0       | 0        |
| Internal, dB L <sub>eq</sub>  | 30.9      | 35.0    | 23.2    | 24.6    | 24.2     |
| Internal, dB L <sub>Aeq</sub> | 14.8      | 26.4    | 20.0    | 24.6    | 25.4     |

### Façade Components

|         |                              |
|---------|------------------------------|
| Wall    | Brick and block, 75mm cavity |
| Roof    | Not Within Roof Space        |
| Glazing | Double Glazing               |
| Vents   | Hit & miss trickle vent      |

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left( \frac{A_0}{S} 10^{\frac{-D_{0,2}}{10}} + \frac{S_{wl}}{S} 10^{\frac{-R_{wl}}{10}} + \frac{S_{fw}}{S} 10^{\frac{-R_{fw}}{10}} + \frac{S_{n}}{S} 10^{\frac{-R_n}{10}} \right) + 10 \log_{10} \left( \frac{S}{A} \right) + 3$$

## APPENDIX G – BS4142 Calculations & Maekawa Barrier Calculations

Noise Impact – No boundary fencing

| NSR      | LAeq | r1   | r2   | SSL    | BS4142 Penalties |      |      | Rating | BG             | Difference | Impact                |
|----------|------|------|------|--------|------------------|------|------|--------|----------------|------------|-----------------------|
|          |      |      |      |        | Int'             | Imp' | Ton' |        |                |            |                       |
| Location | dB   | m    | m    | dB LAs | dB               | dB   | dB   | dB LAr | dB LA90, 1hour | dB         | BS4142                |
| Plot 3   | 56   | 11.8 | 13.9 | 55.3   | 6                |      |      | 61.3   | 43             | 18.3       | Significantly Adverse |
| Plot 4   | 56   | 11.8 | 37   | 51.0   | 6                |      |      | 57.0   | 43             | 14.0       | Significantly Adverse |

Noise Impact – proposed 2.0m Jacksons Jakoustic® Fencing

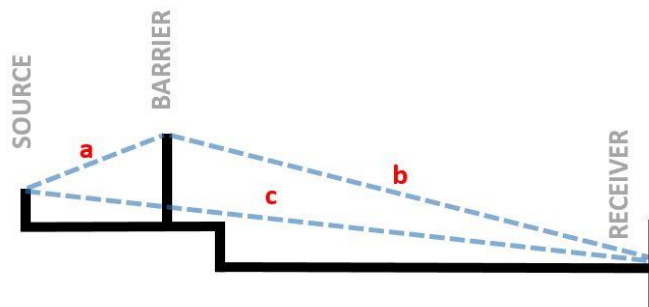
| NSR      | LAeq | r1   | r2   | SSL    | 2.0m Barrier | BS4142 Penalties |      |      | Rating | BG             | Difference | Impact  |
|----------|------|------|------|--------|--------------|------------------|------|------|--------|----------------|------------|---------|
|          |      |      |      |        |              | Int'             | Imp' | Ton' |        |                |            |         |
| Location | dB   | m    | m    | dB LAs | dB           | dB               | dB   | dB   | dB LAr | dB LA90, 1hour | dB         | BS4142  |
| Plot 3   | 56   | 11.8 | 13.9 | 55.3   | 9.3          | 6                |      |      | 52.0   | 43             | 9.0        | Adverse |
| Plot 4   | 56   | 11.8 | 37   | 51.0   | 6.8          | 6                |      |      | 50.2   | 43             | 7.2        | Adverse |

Noise Impact – recommended enhanced 3.0m Jacksons Jakoustic® Fencing

| NSR      | LAeq | r1   | r2   | SSL    | 3.0m Barrier | BS4142 Penalties |      |      | Rating | BG             | Difference | Impact |
|----------|------|------|------|--------|--------------|------------------|------|------|--------|----------------|------------|--------|
|          |      |      |      |        |              | Int'             | Imp' | Ton' |        |                |            |        |
| Location | dB   | m    | m    | dB LAs | dB           | dB               | dB   | dB   | dB LAr | dB LA90, 1hour | dB         | BS4142 |
| Plot 3   | 56   | 11.8 | 13.9 | 55.3   | 14.4         | 6                |      |      | 46.9   | 43             | 3.9        | Low    |
| Plot 4   | 56   | 11.8 | 37   | 51.0   | 12.1         | 6                |      |      | 45.0   | 43             | 2.0        | Low    |

| Plot 1 - 1.8m Brick Wall Calculation |      |             |
|--------------------------------------|------|-------------|
| Barrier Calculation                  | Unit |             |
| Distance - Barrier to Source         | m    | 3.9         |
| Height - Source from Ground          | m    | 1           |
| Distance - Barrier to NSR            | m    | 5           |
| Height - NSR from Ground             | m    | 1.5         |
| Height - Barrier Top from Ground     | m    | 1.8         |
| <b>(C) Direct Path</b>               | m    | 8.9         |
| <b>(A) Source-to BarrierTop</b>      | m    | 3.98        |
| <b>(B) NSR-to-BarrierTop</b>         | m    | 5.01        |
| <b>Path Diff.</b>                    | m    | <b>0.08</b> |
| Nominal Frequency                    | Hz   | 500         |
| Velocity                             | m/s  | 343         |
| Wavelength                           | m    | 0.686       |
| Fresnel Number (N)                   | -    | 0.22        |
| <b>Barrier Attenuation A, (dB)</b>   |      | <b>8.7</b>  |
| Pre-Mitigation External Level        | dB   | 61.3        |
| Mitigated External Level at Receiver | dB   | 52.6        |

| Plot 2 - 1.8m Brick Wall Calculation |      |             |
|--------------------------------------|------|-------------|
| Barrier Calculation                  | Unit |             |
| Distance - Barrier to Source         | m    | 7.3         |
| Height - Source from Ground          | m    | 1           |
| Distance - Barrier to NSR            | m    | 3           |
| Height - NSR from Ground             | m    | 1.5         |
| Height - Barrier Top from Ground     | m    | 1.8         |
| <b>(C) Direct Path</b>               | m    | 10.3        |
| <b>(A) Source-to BarrierTop</b>      | m    | 7.34        |
| <b>(B) NSR-to-BarrierTop</b>         | m    | 3.01        |
| <b>Path Diff.</b>                    | m    | <b>0.05</b> |
| Nominal Frequency                    | Hz   | 500         |
| Velocity                             | m/s  | 343         |
| Wavelength                           | m    | 0.686       |
| Fresnel Number (N)                   | -    | 0.14        |
| <b>Barrier Attenuation A, (dB)</b>   |      | <b>7.6</b>  |
| Pre-Mitigation External Level        | dB   | 61.3        |
| Mitigated External Level at Receiver | dB   | 53.7        |



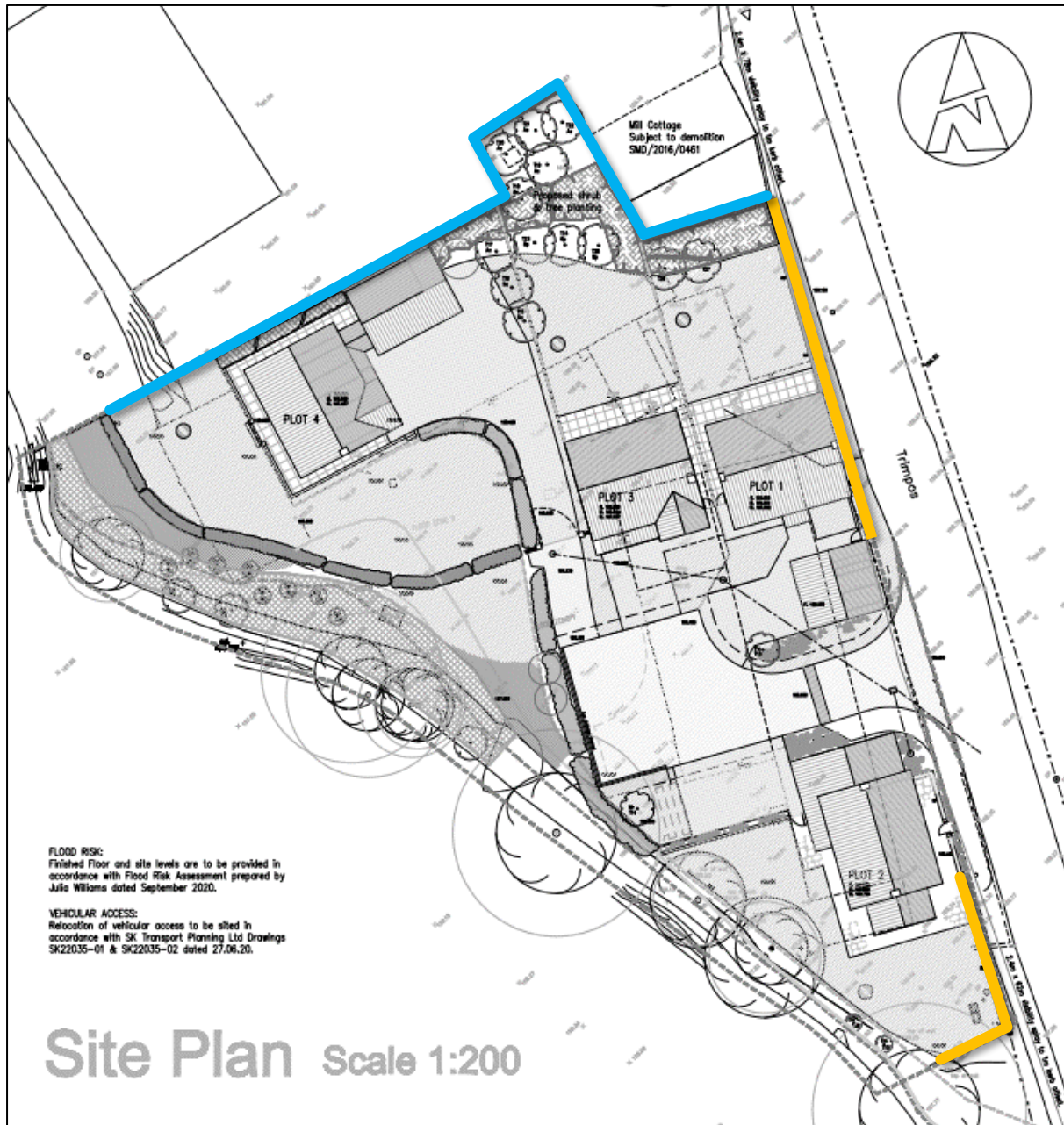
| Plot 3 - 2.0m acoustic fencing     |      |             |
|------------------------------------|------|-------------|
| Barrier Calculation                | Unit |             |
| Distance - Barrier to Source       | m    | 5.3         |
| Height - Source from Ground        | m    | 1           |
| Distance - Barrier to NSR          | m    | 19          |
| Height - NSR from Ground           | m    | 1.5         |
| Height - Barrier Top from Ground   | m    | 2           |
| <b>(C) Direct Path</b>             | m    | 24.3        |
| <b>(A) Source-to BarrierTop</b>    | m    | 5.39        |
| <b>(B) NSR-to-BarrierTop</b>       | m    | 19.01       |
| <b>Path Diff.</b>                  | m    | <b>0.09</b> |
| Nominal Frequency                  | Hz   | 500         |
| Velocity                           | m/s  | 343         |
| Wavelength                         | m    | 0.686       |
| Fresnel Number (N)                 | -    | 0.28        |
| <b>Barrier Attenuation A, (dB)</b> |      | <b>9.3</b>  |

| Plot 4 - 2.0m acoustic fencing     |      |             |
|------------------------------------|------|-------------|
| Barrier Calculation                | Unit |             |
| Distance - Barrier to Source       | m    | 35          |
| Height - Source from Ground        | m    | 1           |
| Distance - Barrier to NSR          | m    | 6.5         |
| Height - NSR from Ground           | m    | 1.5         |
| Height - Barrier Top from Ground   | m    | 2           |
| <b>(C) Direct Path</b>             | m    | 41.5        |
| <b>(A) Source-to BarrierTop</b>    | m    | 35.01       |
| <b>(B) NSR-to-BarrierTop</b>       | m    | 6.52        |
| <b>Path Diff.</b>                  | m    | <b>0.03</b> |
| Nominal Frequency                  | Hz   | 500         |
| Velocity                           | m/s  | 343         |
| Wavelength                         | m    | 0.686       |
| Fresnel Number (N)                 | -    | 0.09        |
| <b>Barrier Attenuation A, (dB)</b> |      | <b>6.8</b>  |

| Plot 3 - 3.0m acoustic fencing     |      |             |
|------------------------------------|------|-------------|
| Barrier Calculation                | Unit |             |
| Distance - Barrier to Source       | m    | 5.3         |
| Height - Source from Ground        | m    | 1           |
| Distance - Barrier to NSR          | m    | 19          |
| Height - NSR from Ground           | m    | 1.5         |
| Height - Barrier Top from Ground   | m    | 3           |
| <b>(C) Direct Path</b>             | m    | 24.3        |
| <b>(A) Source-to BarrierTop</b>    | m    | 5.66        |
| <b>(B) NSR-to-BarrierTop</b>       | m    | 19.06       |
| <b>Path Diff.</b>                  | m    | <b>0.42</b> |
| Nominal Frequency                  | Hz   | 500         |
| Velocity                           | m/s  | 343         |
| Wavelength                         | m    | 0.686       |
| Fresnel Number (N)                 | -    | 1.22        |
| <b>Barrier Attenuation A, (dB)</b> |      | <b>14.4</b> |

| Plot 4 - 3.0m acoustic fencing     |      |             |
|------------------------------------|------|-------------|
| Barrier Calculation                | Unit |             |
| Distance - Barrier to Source       | m    | 35          |
| Height - Source from Ground        | m    | 1           |
| Distance - Barrier to NSR          | m    | 6.5         |
| Height - NSR from Ground           | m    | 1.5         |
| Height - Barrier Top from Ground   | m    | 3           |
| <b>(C) Direct Path</b>             | m    | 41.5        |
| <b>(A) Source-to BarrierTop</b>    | m    | 35.06       |
| <b>(B) NSR-to-BarrierTop</b>       | m    | 6.67        |
| <b>Path Diff.</b>                  | m    | <b>0.22</b> |
| Nominal Frequency                  | Hz   | 500         |
| Velocity                           | m/s  | 343         |
| Wavelength                         | m    | 0.686       |
| Fresnel Number (N)                 | -    | 0.66        |
| <b>Barrier Attenuation A, (dB)</b> |      | <b>12.1</b> |

## APPENDIX H – Boundary Mitigation Location



- Recommended 1.8m brick wall location
- Recommended 3.0m Jacksons Acoustic Fencing Location

## APPENDIX I – Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples common environments and their typical noise levels.

| Noise Level      | Environment                |
|------------------|----------------------------|
| 0 dB(A)          | Threshold of hearing       |
| 20 to 30 dB(A)   | Quiet bedroom at night     |
| 30 to 40 dB(A)   | Living room during the day |
| 40 to 50 dB(A)   | Typical office             |
| 50 to 60 dB(A)   | Inside a moving car        |
| 60 to 70 dB(A)   | Typical high street        |
| 100 to 110 dB(A) | Fire alarm at 1 metre away |
| 140 dB(A)        | Threshold of pain          |

### Terminology

**dB (decibel)** – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ( $2 \times 10^{-5}$  Pa – threshold of hearing).

**$L_{Aeq, T}$**  – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level in which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

**$L_{Amax}$**  – The maximum RMS A-weighted sound pressure level occurring within a specified time period; the time weighting is typically either Fast or Slow.

**$L_{A90}$**  – The A-weighted, sound level just exceeded for 90% of the measurement period and calculated by statistical analysis.

**A-Weighting** – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

**$R_w$**  – The Weighted Sound Reduction Index ( $R_w$ ) is a number used to rate the effectiveness of a soundproofing system or material.

**$D_{n,e,w}$**  – The Weighted Sound Reduction Index specifically for ventilators.

**$C_{tr}$**  –  $C_{tr}$  is a spectrum adaptation term which method is defined in BS EN ISO 717. The standard uses a reference curve to determine the weighted value of airborne sound insulation. The spectrum adaptation terms C and  $C_{tr}$  are used to take into account different source spectra. ' $C_{tr}$ ' is the A-weighted urban traffic noise spectrum.



## Let us introduce ourselves

Peak Acoustics formed in 2011, we are a fully accredited specialist consultancy and testing organisation.

We are a diverse team of Acoustic Consultants, Specialist Engineers and Building Compliance Technicians, with a network spanning the UK. We are proud to offer our services nationally, with no job too big or small.

We provide Acoustic Consultancy, Building Compliance Testing and Energy Services.

## Additional Services

We offer an extensive range of services in the sectors of Acoustic Consultancy, Building Compliance & Energy Efficiency. We are able to put together custom packages combining multiple services which saves both time and money for you.

### Building Compliance

- Sound Insulation Testing
- Air Tightness Testing
- Ventilation Testing
- Water Efficiency Calculations
- Sound Insulation Specification

### Energy Efficiency

- SAP Calculations
- EPC's
- SBEM Calculations
- Energy Statements
- Sustainability Statements
- MEES Regulations
- Commercial EPC's

### Acoustic Consultancy

- Noise Assessment for planning conditions
- Construction site noise monitoring
- Noise at work assessments
- Noise & Vibration Impact Assessments

### Peace of mind

We are accredited and registered by all the relevant major UK authorities to provide the services we offer. Peak Acoustics is UKAS accredited for sound insulation testing, ATTMA registered for Air Leakage Testing. and our Energy team are all Domestic On-Completion Energy Assessors.

### Our Added Value

We combine our detailed knowledge of building regulations with our technical understanding of building physics, acoustics and environmental sciences to maximise development quality. Our work ensures appropriate strategies and studies are prepared to demonstrate to local authorities how proposed developments will be of high quality and generate acceptable impact on the surrounding environment.

## Contact Us

### Head Office:

Peak Acoustics  
Fernbank House  
Springwood Way, Macclesfield, SK10 2XA

Tel: 0330 043 1764

Email: [sales@acousticsurveys.co.uk](mailto:sales@acousticsurveys.co.uk)

Website: [acousticsurveys.co.uk](http://acousticsurveys.co.uk)

### Opening hours

Mon - Fri: 8:30 - 17:00