

Apartment Development, 59 Hope Street, Wrexham LL11 1BE

# Noise Assessment

for Ainsley Gommon Architects, 1 Price St., Hamilton Sq., Birkenhead, CH41 6JN

|                                      |                             |                                 |                                      |                                      |                                         |
|--------------------------------------|-----------------------------|---------------------------------|--------------------------------------|--------------------------------------|-----------------------------------------|
| <b>Our Reference</b><br>21847R01JPSW | <b>Your Reference:</b><br>- | <b>Issue Date</b><br>11/04/2023 | <b>Author</b><br>Joel Phillips AMIOA | <b>Approver</b><br>Sam Williams MIOA | <b>Revision History</b><br>First Issue. |
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## Executive Summary

Environoise Consulting Limited has been commissioned by Ainsley Gommon Architects to undertake a noise assessment to inform the planning application for a proposed 2-apartment development with ground floor commercial use at 59 Hope Street, Wrexham, LL11 1BE.

The development aims to retain and refurbish the existing ground floor retail space and convert the above previous office space on the 1<sup>st</sup> and 2<sup>nd</sup> floors into two residential apartments.

A noise survey was done between Thursday 2<sup>nd</sup> March and Monday 6<sup>th</sup> March 2023 to inform an external noise ingress assessment and plant limits review.

Minimum glazing and ventilation sound insulation performances are given to meet BS 8222:2014 internal noise level targets as follows:

### Glazing & Ventilation

All windows to Bedrooms overlooking Hope Street -

Glazing:  $\geq 44\text{dB } R_w + C_{tr}$   
Trickle ventilation units:  $\geq 48\text{dB } D_{ne,w}$

All windows to Living Spaces overlooking Hope Street -

Glazing:  $\geq 44\text{dB } R_w + C_{tr}$   
Trickle ventilation units:  $\geq 35\text{dB } D_{ne,w}$

All windows and glazed doors to Bedrooms overlooking rear -

Glazing:  $\geq 25\text{dB } R_w + C_{tr}$   
Trickle ventilation units:  $\geq 42\text{dB } D_{ne,w}$

### Plant Noise Limits

Plant noise limits have been provided for any proposed fixed external plant serving the building to achieve a 'low impact' according to BS 4142:2014 at the proposed NSR's.

# 1 Criteria

## 1.1 Internal Ambient Noise Levels

- 1.1.1 We have referred to guidance given in Table 4 of BS 8233 'Guidance on sound insulation and noise reduction for buildings'<sup>i</sup> and World Health Organisation (WHO) Guidelines; 'Community and Noise, 1999'<sup>ii</sup> to recommend internal ambient and maximum noise levels respectively to be achieved in habitable spaces, see Table 1.1. The maximum noise level criterion should not be exceeded more than 10 times during the night-time period (23.00 – 07.00hrs).

**Table 1.1:** Recommended internal noise level targets.

| Activity                   | Location    | 07:00 to 23:00        | 23:00 to 07:00                               |
|----------------------------|-------------|-----------------------|----------------------------------------------|
| Dining                     | Dining Room | 40dB $L_{Aeq,16hour}$ | N/A                                          |
| Resting                    | Living Room | 35dB $L_{Aeq,16hour}$ |                                              |
| Sleeping (daytime resting) | Bedroom     | 35dB $L_{Aeq,16hour}$ | 30dB $L_{Aeq,8hour}$<br>45dB $L_{Amax,fast}$ |

## 2 Noise Survey

### 2.1 Site Description

- 2.1.1 The proposal site consists of a three-storey building with a ground floor commercial unit permitted for retail use only and two floors of office accommodation above. The adjoining building to the north is currently being converted from an office building to new residential units and there are several other commercial businesses in the area including 'The Bank Wine Bar and Bistro' and 'One to Five', situated 30 metres South and the 'Ironworks' approximately 50 metres South-West. Various other night-life type establishments operate along High St and Town Hill. Access is to be provided via Hope Street into a ginnel.
- 2.1.2 Three condenser units and two extractors attached to neighbouring properties located in the rear ginnel were observed at both set up and collection of noise survey equipment and were not in use and therefore have not been considered in this assessment. Should the plant be used in the future then a further noise assessment may be necessary in order to consider their impact on the proposed residential properties.

### 2.2 Noise Survey Details

- 2.2.1 An unattended noise survey was done between 10.30hrs, Thursday 2<sup>nd</sup> March and 10.45hrs, Monday 6<sup>th</sup> March 2023 measuring contiguous A-weighted background, ambient and maximum noise levels ( $L_{A90(15min)}$ ,  $L_{Aeq,15min}$ ,  $L_{Amax,fast}$ ) for 15-minute periods. Measurements were made one metre out of a partially open window at the following positions, see Figure 2.1.
- **Position 1:** First storey window overlooking Hope Street.
  - **Position 2:** Second storey window overlooking rear ginnel.

**Figure 2.1:** Proposed site and noise measurement positions.



## Calibration

- 2.2.2 The sound level meter was calibrated at the start and end of the noise surveys. The meter was calibrated to 94.0dB at 1kHz with no recorded drift greater than 0.3dB at 1 kHz; therefore, the measurements are acceptable. Details of instrumentation and calibration are available on request.
- 2.2.3 Due to the night-time ambient levels being higher than the daytime, audio recordings taken during the survey have been examined and we've identified the heightened night-time levels to be a combination of loud shouting from pedestrians passing along Hope Street, bass-heavy music emanating from pubs/bars in the close vicinity and street cleaners operating in the early hours of the morning.

## 2.3 Ambient & Maximum Noise Levels

2.3.1 Table 2.1 presents the logarithmically averaged daytime and night-time ambient ( $L_{eq}$ ) noise levels for each measurement position. Time histories of noise survey results are presented in Figures A1 and A2, Appendix A.

**Table 2.1:** Highest logarithmically averaged daytime and night-time ambient noise levels at each position.

| Position | Period                                    | $L_{eq,T}$ at octave band centre frequency (Hz) dB |     |     |     |    |    |    | $L_{Aeq,T}$ (dB) |
|----------|-------------------------------------------|----------------------------------------------------|-----|-----|-----|----|----|----|------------------|
|          |                                           | 63                                                 | 125 | 250 | 500 | 1k | 2k | 4k |                  |
| 1        | Daytime (07.00 – 23.00, 04/03/2023)       | 70                                                 | 67  | 60  | 59  | 57 | 53 | 48 | 62               |
|          | Night-time (23.00 – 07.00hrs, 04/03/2023) | 75                                                 | 70  | 63  | 61  | 60 | 54 | 48 | 64               |
| 2        | Daytime (07.00 – 23.00, 05/03/2023)       | 51                                                 | 50  | 44  | 44  | 45 | 41 | 34 | 49               |
|          | Night-time (23.00 – 07.00hrs, 04/03/2023) | 60                                                 | 55  | 48  | 43  | 41 | 36 | 28 | 46               |

2.3.2 Noise data measured at Position 1 between 08.30 and 10.00hrs on 5<sup>th</sup> March 2023 has been excluded as undue elevation occurred attributable to construction works in close vicinity.

2.3.3 Table 2.2 presents the fifth highest maximum ( $L_{max,fast}$ ) noise level during the measured night-time periods at each position. Although the maximum noise level criterion is not to be exceeded more than 10 – 15 times during a night-time period, we have used the fifth highest due to the measurement period of 15-minutes potentially including multiple noise events.

**Table 2.2:** Night-time maximum noise level at each position.

| Position | Measurement                       | $L_{max,fast}$ at octave band centre frequency (Hz) dB |     |     |     |    |    |    | $L_{Amax,fast}$ (dB) |
|----------|-----------------------------------|--------------------------------------------------------|-----|-----|-----|----|----|----|----------------------|
|          |                                   | 63                                                     | 125 | 250 | 500 | 1k | 2k | 4k |                      |
| 1        | Night-time (05.30hrs, 05/03/2023) | 82                                                     | 85  | 85  | 82  | 82 | 80 | 77 | 87                   |
| 2        |                                   | 64                                                     | 63  | 67  | 67  | 68 | 64 | 60 | 71                   |

## 2.4 Background Noise Levels

2.4.1 To assess the impact of noise from any fixed external plant of nearby sensitive receptors, BS4142:2014 requires the use of a 'representative' background noise level. We have determined the representative background noise level to be the modal value for both the daytime and night-time, see Table 2.3.

**Table 2.3:** Background (L<sub>A90</sub>) noise levels for daytime and night-time periods.

| Position | Date       | Period     | Measured background noise level [L <sub>A90</sub> (15min) (dB)] |                      |
|----------|------------|------------|-----------------------------------------------------------------|----------------------|
|          |            |            | Range                                                           | Representative value |
| 1        | 02/03/2023 | Daytime    | 42 – 55                                                         | 50                   |
|          |            | Night-time | 36 – 50                                                         | 42                   |
|          | 03/03/2023 | Daytime    | 43 – 62                                                         | 51                   |
|          |            | Night-time | 38 – 65                                                         | 38                   |
|          | 04/03/2023 | Daytime    | 41 – 65                                                         | 49                   |
|          |            | Night-time | 38 – 66                                                         | 41                   |
|          | 05/03/2023 | Daytime    | 42 – 59                                                         | 49                   |
|          |            | Night-time | 41 – 46                                                         | 41                   |
|          | 06/03/2023 | Daytime    | 47 – 52                                                         | 50                   |
|          |            | Night-time | 35 – 44                                                         | 42                   |
| 2        | 02/03/2023 | Daytime    | 35 – 44                                                         | 42                   |
|          |            | Night-time | 33 – 38                                                         | 34                   |
|          | 03/03/2023 | Daytime    | 37 – 45                                                         | 41                   |
|          |            | Night-time | 33 – 47                                                         | 34                   |
|          | 04/03/2023 | Daytime    | 36 – 48                                                         | 43                   |
|          |            | Night-time | 33 – 49                                                         | 35                   |
|          | 05/03/2023 | Daytime    | 35 – 41                                                         | 38                   |
|          |            | Night-time | 34 – 40                                                         | 34                   |
|          | 06/03/2023 | Daytime    | 38 – 41                                                         | 40                   |
|          |            | Night-time | 33 – 38                                                         | 34                   |

## 3 Noise Ingress Assessment

### 3.1 Assessment

- 3.1.1 Noise ingress levels have been calculated in accordance with BS EN 12354-3:2000<sup>iii</sup> with a reverberation time of 0.6 seconds for living spaces and 0.5 seconds for bedrooms. Living room, bedroom and glazing dimensions have been determined from architectural drawings received<sup>1</sup>. Example noise ingress calculations are shown in Appendix B. Calculations consider a -3dB correction to convert measured façade levels to free-field equivalent.

#### Building Envelope Constructions

- 3.1.2 Detailed building envelope constructions are not available at this stage; however, an outline façade build-up has been provided by Ainsley Gommon Architects. We have modelled<sup>2</sup> the proposed constructions and the corresponding octave band sound reduction indices (R) are given in Table 3.1.

**Table 3.1:** Sound insulation performances for building envelope constructions.

| Building element       | Construction                                                                                                                                            | Sound reduction indices (R) (dB) |     |     |     |    |    |    | R <sub>w</sub> + C <sub>tr</sub> (dB) |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----|-----|-----|----|----|----|---------------------------------------|
|                        |                                                                                                                                                         | 63                               | 125 | 250 | 500 | 1k | 2k | 4k |                                       |
| Proposed External Wall | <ul style="list-style-type: none"> <li>2 courses of 102.5mm brick (1600kg/m<sup>3</sup>) (existing)</li> <li>Waterproof membrane</li> </ul>             |                                  |     |     |     |    |    |    |                                       |
|                        | <ul style="list-style-type: none"> <li>75mm Celotex insulation (assumed 10kg/m<sup>3</sup>)</li> <li>25x45mm timber battens at 600mm centres</li> </ul> | 36                               | 50  | 55  | 63  | 75 | 79 | 81 | 61                                    |
|                        | <ul style="list-style-type: none"> <li>1 layer of 12.5mm standard plasterboard (≥8kg/m<sup>2</sup>, e.g. Gyproc WallBoard)</li> </ul>                   |                                  |     |     |     |    |    |    |                                       |
|                        |                                                                                                                                                         |                                  |     |     |     |    |    |    |                                       |

<sup>1</sup> Drawings received from Tom McEvoy, Ainsley Gommon Architects in email to Joel Phillips, Environoise Consulting dated 03<sup>rd</sup> March 2023.

<sup>2</sup> Using Insul 9.0.20 modelling software. +/- 3dB margin of error.

## 3.2 Ventilation

### Purge (Approved Document F)

- 3.2.1 Openable windows to all habitable spaces for the purpose of purge ventilation is permitted as internal noise level targets are not applicable during these conditions. The openable window specification should comply with the requirements given in Appendix B of The Building Regulations 'Approved Document F: Ventilation'<sup>iv</sup>.

### Overheating (Approved Document O)

- 3.2.2 Should overheating be a potential concern for the development, Requirement 01(2)(a) section 3 of The Building Regulations 'Approved Document O: Overheating'<sup>v</sup> states that windows are likely to be closed where internal noise levels in bedrooms exceed the following noise levels:

40dB  $L_{Aeq,T}$ , averaged over 8 hours (between 23.00 and 07.00hrs)

55dB  $L_{Amax,fast}$ , no more than 10 times a night (between 23.00 and 07.00hrs)

- 3.2.3 Where an ADO 'simplified method' assessment by the M&E consultant determines a 'medium' and 'high' risk of overheating, the ADO noise parameters will not be met based on an open window strategy alone for all glazed windows based on site noise levels presented in Section 2.3.
- 3.2.4 For bedrooms, it is likely that a further ADO dynamic thermal modelling assessment would be required, with an alternative strategy (e.g. louvered wall vents, mechanical ventilation / cooling system) to remove excess heat considered by the M&E and noise consultant at an early design stage so compliance with ADO can be demonstrated.

## 3.3 Recommendations

- 3.3.1 Specifications have been assessed against a typical maximum noise level event caused by patron noise/music noise breakout and street cleaner noise. Suitable window glazing and background ventilation specification performances and locations are recommended in Table 3.2. As per planning conditions existing window glazing and frames are to be retained and made good therefore secondary glazing is proposed to all windows overlooking Hope Street.

**Table 3.2:** Recommended minimum glazing and trickle vent sound insulation performances.

| Location                                        | Glazing performance<br>[ $\geq R_w + C_{tr}$ (dB)] | Example glazing spec                                                  | Vent performance<br>[ $\geq D_{ne,w}$ (dB)] | Example vent type  |
|-------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------|--------------------|
| All windows to Bedrooms overlooking Hope Street | 44                                                 | Existing glazing (assumed 3mm) / 200mm cavity / 12.8mm laminated pane | 48                                          | Invisivent Extreme |

**Table 3.2 (continued):** Recommended minimum glazing and trickle vent sound insulation performances.

| Location                                             | Glazing performance<br>[ $\geq R_w + C_{tr}$ (dB)] | Example glazing spec                                                  | Vent performance<br>[ $\geq D_{ne,w}$ (dB)] | Example vent type   |
|------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------|---------------------|
| All windows to Living Spaces overlooking Hope Street | 44                                                 | Existing glazing (assumed 3mm) / 200mm cavity / 12.8mm laminated pane | 35                                          | Standard vent / C25 |
| All windows to Bedrooms overlooking Rear             | 25                                                 | Existing (assumed 3mm) single pane                                    | 42                                          | Titon V75 / C50     |

- 3.3.2 As secondary glazing is proposed to all windows at the front overlooking Hope Street, trickle ventilation with the minimum sound insulation performance given in Table 3.2 should be fitted to both window frames to facilitate ventilation through the glazing system into the residential space whilst suitably mitigating external noise.
- 3.3.3 All existing glazing and window framing should be made good so that no gaps remain, and any failed seals are replaced. The secondary glazed panes should be fixed, side or top hung with and not sliding or sash mechanisms which typically reduces the in-situ sound insulation performance.
- 3.3.4 The glazing performance should be constant across the overall assembly, so the framing should be the same or greater performance than the glazing recommended. The performance of the glazing units also depends on the quality of framing and good contact with window seals.

## 4 Plant Noise Limits

### 4.1 Criteria

#### BS 4142+A1:2019

4.1.1 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'<sup>vi</sup> provides a method of determining the 'impact of specific sound' on dwellings due to industrial and commercial noise sources through comparison between the measured background noise level ( $L_{A90}$ ) and the noise source rating level ( $L_{A,Tr}$ ) under consideration. The rating level is the specific noise level plus penalties of up to 18dB added for features to account for the character of the noise as follows:

- **Tonality:** +2dB penalty: Just perceptible; +4dB penalty: Clearly perceptible and +6dB penalty: Highly perceptible.
- **Impulsivity:** +3dB penalty: Just perceptible; +6dB penalty: Clearly perceptible and +9dB penalty: Highly perceptible.
- **Intermittency:** +3dB penalty: identifiable on/ off conditions.

4.1.2 When comparing the rating plant noise level against the background noise level, BS 4142:2014 provides the following noise impact descriptors:

- +10dB(A) is likely to be an indicator of 'a significant impact, depending on the context'.
- +5dB(A) is likely to be an indicator of 'an adverse impact, depending on the context'.
- No excess of the background noise level is an indicator of 'a low impact, depending on the context'.

### 4.2 Noise Targets at Proposed NSRs

4.2.1 Any proposed fixed external plant should meet the noise limits given in Table 4.1 when measured at 1m from the nearest NSR to meet a 'low impact' as per BS 4142. The representative background noise level has been determined from the modal analysis of background levels ( $L_{A90,15min}$ ) from measurement positions 1 and 2.

**Table 4.1:** Plant noise limits at existing residential receptors.

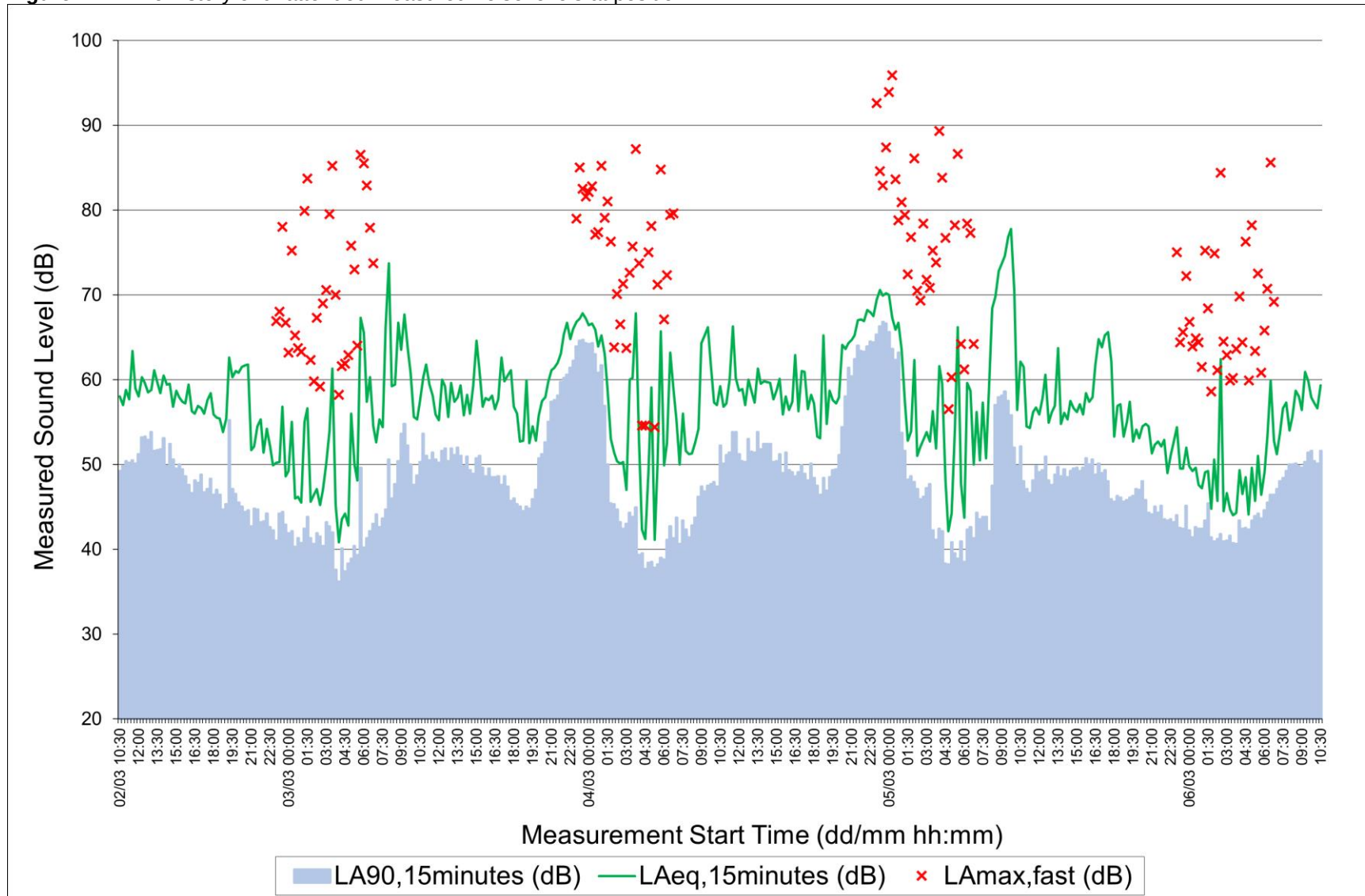
| NSR location            | Period                        | Representative background noise level<br>[L <sub>A90</sub> (15mins) (dB)] | Plant rating noise limiting level at 1m from NSR<br>[L <sub>Aeq,T</sub> (dB)] |
|-------------------------|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Overlooking Hope Street | Daytime (07.00 - 23.00hrs)    | 49                                                                        | 49                                                                            |
|                         | Night-time (23.00 – 07.00hrs) | 38                                                                        | 38                                                                            |
| Overlooking Rear        | Daytime (07.00 - 23.00hrs)    | 38                                                                        | 38                                                                            |
|                         | Night-time (23.00 – 07.00hrs) | 34                                                                        | 34                                                                            |

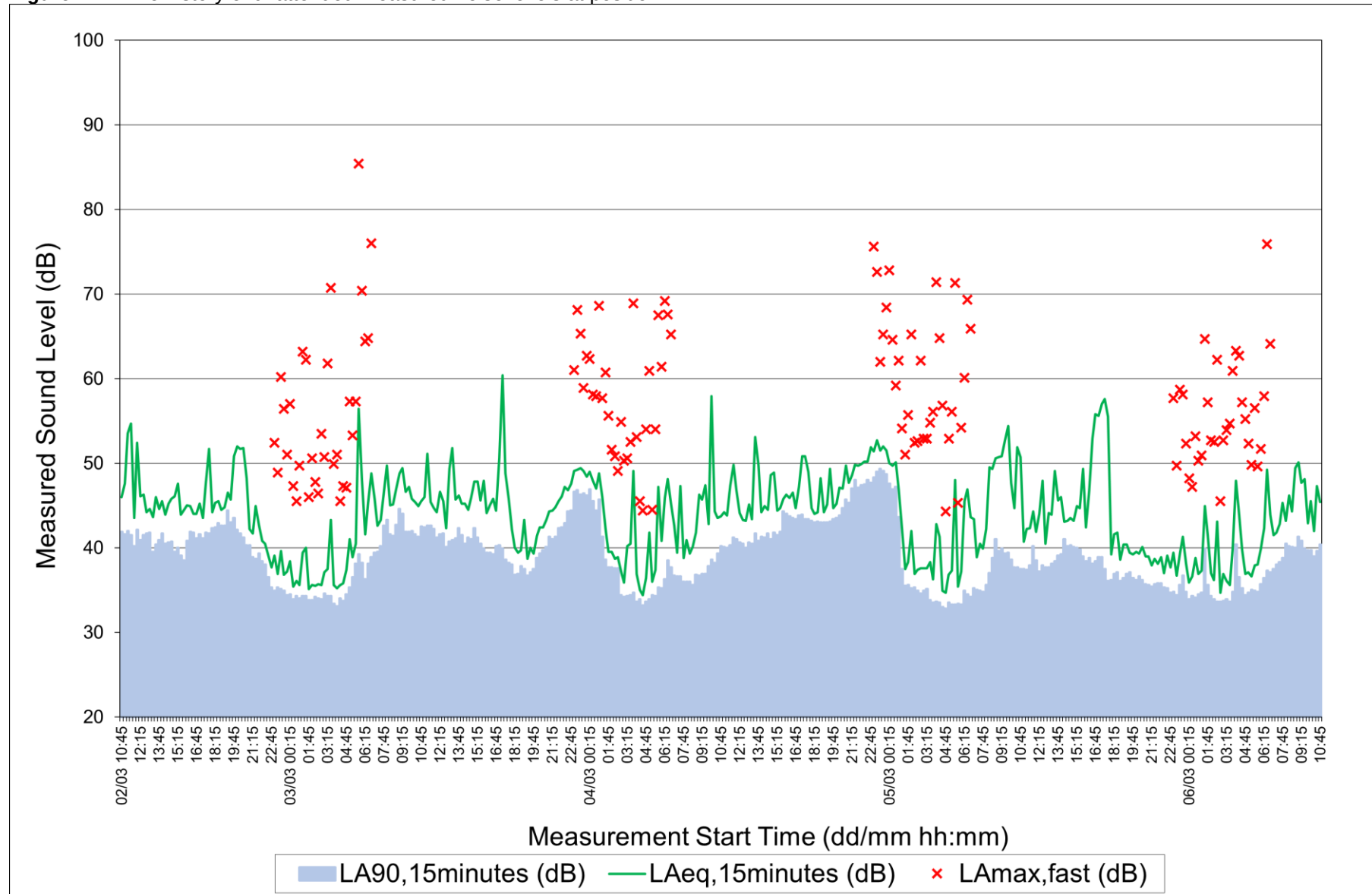
### Noise Penalty

- 4.2.2 A noise character correction should be applied if the plant contains any tonal, intermittent, or impulsive acoustic characteristics in accordance with BS 4142. It should be noted that the plant noise limiting levels shown in Table 4.1 are the highest allowable noise levels at 1 metre from the nearest receptor from all proposed external plant associated with the development in simultaneous operation.

## Appendix A: Noise Data

**Figure A1:** Time history of unattended measured noise levels at position 1.



**Figure A2:** Time history of unattended measured noise levels at position 2.

## Appendix B: Calculations

**Figure B1:** Noise ingress calculation – Bedroom 1, Unit 1, night-time.

|  <div>Leq, Bedroom 1</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------|------|------|------|------|------|------|--------------|-------------------------|------|-----|-----|-----|------|------|------|------|----------|--------------------------|--------|------|------|------|------|------|------|------|--------------|----------------------|--------|------|------|------|------|------|------|------|----|---------------------------|--------|----|----|----|----|----|----|----|---------|--------------|--|----|----|----|----|----|----|----|----|
| Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 21847, Hope Street, Wrexham |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Client                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Room                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | First Floor, Bed1           | Night |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Enter Facade Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3 dB                        |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Receiving Room</div> <div> <div>Height of room</div> <div>2.4 m</div> </div> <div> <div>Width of room</div> <div>3.2 m</div> </div> <div> <div>Length of room</div> <div>5.0 m</div> </div> <div> <div>Volume of room</div> <div>38.4 m³</div> </div> <div> <input checked="" type="radio"/> Bedroom<br/> <input type="radio"/> Living Area         </div>                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Element</div> <div>Area 1 - Glazing</div> <div>0.0 m²</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Area 2 - Glazing &amp; TV</div> <div>3.5 m²</div> <div>3/200/12.8 laminated - 50dB Rw (44dB Rw + Ctr)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Area 3 - Non Glazed</div> <div>8.4 m²</div> <div>External Wall ( 2 x 102.5mm rendered dense blockwork, 75mm insulation, Vapour barrier, 25mm battens @600, 12.5mm wall board)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Area 4 - Non Glazed</div> <div></div> <div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Angle of incidence</div> <div>0 deg</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>Frequency Hz</th> <th>63</th> <th>125</th> <th>250</th> <th>500</th> <th>1000</th> <th>2000</th> <th>4000</th> <th>8000</th> <th></th> </tr> </thead> <tbody> <tr> <td>Reverberation time (sec)</td> <td>0.50</td> <td>0.50</td> <td>0.50</td> <td>0.50</td> <td>0.50</td> <td>0.50</td> <td>0.50</td> <td>0.50</td> <td></td> </tr> <tr> <td>Absorption (sabines)</td> <td>12.4</td> <td>12.4</td> <td>12.4</td> <td>12.4</td> <td>12.4</td> <td>12.4</td> <td>12.4</td> <td>12.4</td> <td></td> </tr> </tbody> </table>                                                                                                                                                                                                                    |                             |       |      |      |      |      |      |      |              | Frequency Hz            | 63   | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |          | Reverberation time (sec) | 0.50   | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |              | Absorption (sabines) | 12.4   | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Frequency Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 63                          | 125   | 250  | 500  | 1000 | 2000 | 4000 | 8000 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Reverberation time (sec)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.50                        | 0.50  | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Absorption (sabines)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12.4                        | 12.4  | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 | 12.4 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>Frequency Hz</th> <th>63</th> <th>125</th> <th>250</th> <th>500</th> <th>1000</th> <th>2000</th> <th>4000</th> <th>8000</th> <th></th> </tr> </thead> <tbody> <tr> <td>External dB</td> <td>75</td> <td>70</td> <td>63</td> <td>61</td> <td>60</td> <td>54</td> <td>48</td> <td>48</td> <td>64</td> </tr> <tr> <td>External Freefield</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>External Freefield Leq dB</td> <td>72</td> <td>67</td> <td>60</td> <td>58</td> <td>57</td> <td>51</td> <td>45</td> <td>45</td> <td>61</td> </tr> </tbody> </table>                                                                                                                       |                             |       |      |      |      |      |      |      |              | Frequency Hz            | 63   | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |          | External dB              | 75     | 70   | 63   | 61   | 60   | 54   | 48   | 48   | 64           | External Freefield   |        |      |      |      |      |      |      |      |    | External Freefield Leq dB | 72     | 67 | 60 | 58 | 57 | 51 | 45 | 45 | 61      |              |  |    |    |    |    |    |    |    |    |
| Frequency Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 63                          | 125   | 250  | 500  | 1000 | 2000 | 4000 | 8000 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| External dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 75                          | 70    | 63   | 61   | 60   | 54   | 48   | 48   | 64           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| External Freefield                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |       |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| External Freefield Leq dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 72                          | 67    | 60   | 58   | 57   | 51   | 45   | 45   | 61           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
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| Frequency Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 63                          | 125   | 250  | 500  | 1000 | 2000 | 4000 | 8000 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Additional Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.0                         | 0.0   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| 10log(cos(angle))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.0                         | 0.0   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>SRI Ref</th> <th>Area</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> <th></th> </tr> </thead> <tbody> <tr> <td>Glazing and Trickle Vent</td> <td>3.5 m²</td> <td>18</td> <td>29</td> <td>34</td> <td>39</td> <td>44</td> <td>48</td> <td>58</td> <td>58</td> </tr> <tr> <td>45</td> <td>8.4 m²</td> <td>36</td> <td>50</td> <td>55</td> <td>63</td> <td>75</td> <td>79</td> <td>81</td> <td>81</td> </tr> <tr> <td></td> <td>0.0 m²</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>No data</td> </tr> <tr> <td>Combined SRI</td> <td></td> <td>23</td> <td>34</td> <td>40</td> <td>44</td> <td>49</td> <td>53</td> <td>63</td> <td>63</td> </tr> </tbody> </table> |                             |       |      |      |      |      |      |      |              | SRI Ref                 | Area | 0   | 0   | 0   | 0    | 0    | 0    | 0    |          | Glazing and Trickle Vent | 3.5 m² | 18   | 29   | 34   | 39   | 44   | 48   | 58   | 58           | 45                   | 8.4 m² | 36   | 50   | 55   | 63   | 75   | 79   | 81   | 81 |                           | 0.0 m² | 0  | 0  | 0  | 0  | 0  | 0  | 0  | No data | Combined SRI |  | 23 | 34 | 40 | 44 | 49 | 53 | 63 | 63 |
| SRI Ref                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Area                        | 0     | 0    | 0    | 0    | 0    | 0    | 0    |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Glazing and Trickle Vent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3.5 m²                      | 18    | 29   | 34   | 39   | 44   | 48   | 58   | 58           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8.4 m²                      | 36    | 50   | 55   | 63   | 75   | 79   | 81   | 81           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.0 m²                      | 0     | 0    | 0    | 0    | 0    | 0    | 0    | No data      |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Combined SRI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             | 23    | 34   | 40   | 44   | 49   | 53   | 63   | 63           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>Criterion ( NR at 1kHz)</th> <th>54</th> <th>43</th> <th>34</th> <th>28</th> <th>24</th> <th>21</th> <th>19</th> <th>17</th> <th></th> </tr> </thead> <tbody> <tr> <td>Additional SRI Required</td> <td>0.2</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>To Meet NR24</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                    |                             |       |      |      |      |      |      |      |              | Criterion ( NR at 1kHz) | 54   | 43  | 34  | 28  | 24   | 21   | 19   | 17   |          | Additional SRI Required  | 0.2    | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | To Meet NR24 |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Criterion ( NR at 1kHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 54                          | 43    | 34   | 28   | 24   | 21   | 19   | 17   |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Additional SRI Required                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.2                         | 0.0   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | To Meet NR24 |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>Internal Leq dB</th> <th>55</th> <th>39</th> <th>26</th> <th>20</th> <th>14</th> <th>3</th> <th>-13</th> <th>-13</th> <th>30 dB(A)</th> </tr> </thead> <tbody> <tr> <td>Internal Lfmax dB</td> <td>61</td> <td>54</td> <td>48</td> <td>40</td> <td>35</td> <td>29</td> <td>16</td> <td>16</td> <td>44 dB(A)</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                     |                             |       |      |      |      |      |      |      |              | Internal Leq dB         | 55   | 39  | 26  | 20  | 14   | 3    | -13  | -13  | 30 dB(A) | Internal Lfmax dB        | 61     | 54   | 48   | 40   | 35   | 29   | 16   | 16   | 44 dB(A)     |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Internal Leq dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 55                          | 39    | 26   | 20   | 14   | 3    | -13  | -13  | 30 dB(A)     |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Internal Lfmax dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 61                          | 54    | 48   | 40   | 35   | 29   | 16   | 16   | 44 dB(A)     |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |

**Figure B2:** Noise ingress calculation – Lounge, Unit 1, daytime.

|  <div>Leq, Living Space (LKD)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|------|------|------|------|------|------|--------------|-------------------------|------|-----|-----|-----|------|------|------|------|----------|--------------------------|--------|------|------|------|------|------|------|------|--------------|----------------------|--------|------|------|------|------|------|------|------|----|---------------------------|--------|----|----|----|----|----|----|----|---------|--------------|--|----|----|----|----|----|----|----|----|
| Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 21847 Hope Street, Wrexham |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Client                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Room                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | First Floor, LKD           | Day  |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Enter Facade Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3 dB                       |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Receiving Room</div> <div> <div>Height of room</div> <div>2.4 m</div> </div> <div> <div>Width of room</div> <div>3.2 m</div> </div> <div> <div>Length of room</div> <div>5.0 m</div> </div> <div> <div>Volume of room</div> <div>38.4 m³</div> </div> <div> <input type="radio"/> Bedroom<br/> <input checked="" type="radio"/> Living Area         </div>                                                                                                                                                                                                                                                                                                                                                                                                                  |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Element</div> <div>Area 1 - Glazing</div> <div>0.0 m²</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Area 2 - Glazing &amp; TV</div> <div>3.2 m²</div> <div>3/200/12.8 laminated - 50dB Rw (44dB Rw + Ctr) + Standard vent / C25 (35dB Dne,w)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Area 3 - Non Glazed</div> <div>8.4 m²</div> <div>External Wall ( 2 x 102.5mm rendered dense blockwork, 75mm insulation, Vapour barrier, 25mm battens @600, 12.5mm wall board)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Area 4 - Non Glazed</div> <div></div> <div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <div>Angle of incidence</div> <div>0 deg</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>Frequency Hz</th> <th>63</th> <th>125</th> <th>250</th> <th>500</th> <th>1000</th> <th>2000</th> <th>4000</th> <th>8000</th> <th></th> </tr> </thead> <tbody> <tr> <td>Reverberation time (sec)</td> <td>0.60</td> <td>0.60</td> <td>0.60</td> <td>0.60</td> <td>0.60</td> <td>0.60</td> <td>0.60</td> <td>0.60</td> <td></td> </tr> <tr> <td>Absorption (sabines)</td> <td>10.3</td> <td>10.3</td> <td>10.3</td> <td>10.3</td> <td>10.3</td> <td>10.3</td> <td>10.3</td> <td>10.3</td> <td></td> </tr> </tbody> </table>                                                                                                                                                                                                                    |                            |      |      |      |      |      |      |      |              | Frequency Hz            | 63   | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |          | Reverberation time (sec) | 0.60   | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |              | Absorption (sabines) | 10.3   | 10.3 | 10.3 | 10.3 | 10.3 | 10.3 | 10.3 | 10.3 |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Frequency Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 63                         | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Reverberation time (sec)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.60                       | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Absorption (sabines)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10.3                       | 10.3 | 10.3 | 10.3 | 10.3 | 10.3 | 10.3 | 10.3 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
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| Frequency Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 63                         | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| External dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 70                         | 67   | 60   | 59   | 57   | 53   | 48   | 48   | 62           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| External Freefield                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |      |      |      |      |      |      |      |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| External Freefield Leq dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 67                         | 64   | 57   | 56   | 54   | 50   | 45   | 45   | 59           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
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| Frequency Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 63                         | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Additional Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| 10log(cos(angle))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
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| SRI Ref                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Area                       | 0    | 0    | 0    | 0    | 0    | 0    | 0    |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Glazing and Trickle Vent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3.0 m²                     | 18   | 28   | 31   | 30   | 37   | 34   | 37   | 37           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8.4 m²                     | 36   | 50   | 55   | 63   | 75   | 79   | 81   | 81           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.0 m²                     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | No data      |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Combined SRI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            | 24   | 34   | 36   | 36   | 43   | 40   | 43   | 43           |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| <table border="1"> <thead> <tr> <th>Criterion ( NR at 1kHz)</th> <th>55</th> <th>44</th> <th>35</th> <th>29</th> <th>25</th> <th>22</th> <th>20</th> <th>18</th> <th></th> </tr> </thead> <tbody> <tr> <td>Additional SRI Required</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>To Meet NR25</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                    |                            |      |      |      |      |      |      |      |              | Criterion ( NR at 1kHz) | 55   | 44  | 35  | 29  | 25   | 22   | 20   | 18   |          | Additional SRI Required  | 0.0    | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | To Meet NR25 |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Criterion ( NR at 1kHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 55                         | 44   | 35   | 29   | 25   | 22   | 20   | 18   |              |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
| Additional SRI Required                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.0                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | To Meet NR25 |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |
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| Internal Leq dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 50                         | 37   | 27   | 27   | 18   | 17   | 9    | 9    | 29 dB(A)     |                         |      |     |     |     |      |      |      |      |          |                          |        |      |      |      |      |      |      |      |              |                      |        |      |      |      |      |      |      |      |    |                           |        |    |    |    |    |    |    |    |         |              |  |    |    |    |    |    |    |    |    |

## References

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- <sup>i</sup> BS 8233 'Guidance on sound insulation and noise reduction for buildings', 2014.
- <sup>ii</sup> World Health Organisation (WHO) Guidelines; 'Community and Noise, 1999'
- <sup>iii</sup> BS EN 12354-3:2000 'Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound', 2000.
- <sup>iv</sup> The Building Regulations 'Approved Document F: Ventilation' (2010 edition incorporating 2010 and 2013 amendments).
- <sup>v</sup> The Building Regulations (2010) 'Approved Document O: Overheating' (2021 edition)
- <sup>vi</sup> BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'.