PROPOSED DAY NURSERY,
FALCON HOUSE, WHALLEY ROAD, SABDEN

NOISE IMPACT ASSESSMENT

Report 9477-NIA-01

Prepared on 19 August 2014

Issued For:
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Contents

1.0 INTRODUCTION ................................................................. 2
2.0 SITE DESCRIPTION .......................................................... 2
3.0 PROCEDURE ........................................................................ 3
  3.1 Environmental Noise Survey ............................................. 3
  3.2 Noise Breakout Assessment .............................................. 3
4.0 EQUIPMENT ........................................................................ 4
  4.1 Environmental Noise Survey ............................................. 4
  4.2 Breakout Assessment ....................................................... 4
5.0 RESULTS ............................................................................... 5
  5.1 Environmental Noise Survey ............................................. 5
  5.2 Noise Breakout Levels ....................................................... 5
6.0 NOISE EMISSIONS CRITERIA ............................................ 6
  6.1 External Noise Emissions .................................................. 6
7.0 DISCUSSION – EXTERNAL ACTIVITIES .............................. 7
  7.1 Proposed Activity ............................................................ 7
  7.2 Noise Breakout Assessment – North Playground to Receiver 1.................................................. 7
  7.3 Noise Breakout Assessment – West Playground to Receiver 2...................................................... 8
  7.4 British Standard Requirements ........................................ 9
8.0 DISCUSSION – INTERNAL ACTIVITIES .................................. 10
  8.1 Proposed Activity ............................................................ 10
  8.2 Noise Breakout Assessment – Receiver 1 ............................. 11
  8.3 Noise Breakout Assessment – Receiver 3 ............................. 11
  8.4 British Standard Requirements ........................................ 12
9.0 PROPOSED NOISE MANAGEMENT PLAN ........................... 13
10.0 CONCLUSION .................................................................... 13

List of Attachments

9477-SP1 Indicative Site Plan
9477-TH1 Environmental Noise Time History
Appendix A Glossary of Acoustic Terminology
Appendix B1-2 Acoustic Calculations
1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Andrew Collinson Esq to investigate and assess the noise impact from proposed day nursery activities at Falcon House, Whalley Road, Sabden, BB7 9DZ on nearby residential properties.

This report presents the results of a background noise survey and break out assessment followed by an assessment of the anticipated noise emission levels and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

Proposals are to redevelop an existing office and warehousing facility at Falcon House to comprise day nursery facilities for children of varying ages. The site is bounded by Whalley Road to the north, a bowling club to the east and a new residential development to the south and west. The site is shown in indicative site plan 9477-SP1.

Proposals are to have daytime nursery facilities for babies, toddlers and pre-school age children, as well as a before and after school club for primary school age children.

Proposed operating hours are 07:30 to 18:30 Monday to Saturday. The majority of time will be spent indoors, although it is understood that, barring ‘exceptional’ weather conditions, regular access to outdoor play areas will be made available to children.

The closest residential receivers potentially affected by noise arising from nursery activities are shown indicative site plan 9477-SP1.
3.0 PROCEDURE

3.1 Environmental Noise Survey

In order to assess existing background noise levels in the area, an environmental noise survey was undertaken over a weekend period at the position marked on indicative site plan 9477-SP1.

Continuous automated monitoring was undertaken for the duration of the survey between 16:30 on 15 August 2014 and 15:50 on 18 August 2014. Weather conditions during the survey were generally dry with light winds, therefore suitable for measurement of environmental noise.

Noise levels at the noise monitoring position were predominately influenced by road traffic noise from distant roads.

The measurement procedure generally complied with BS7445:1991. Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use.

3.2 Noise Breakout Assessment

During an on-site inspection potential noise breakout paths have been identified.

High volume “white” noise was generated from two loudspeakers in the proposed areas of the property where children will be, positioned to obtain a diffuse sound field. A spatial average of the resulting one-third octave band noise levels between 50 Hz and 20 kHz was obtained by using a moving microphone technique over a minimum period of 15 seconds at each of two positions.

Measurements were then conducted immediately outside the corresponding facades, in order to investigate the level of breakout noise through different transmission paths.

The duration of measurements ranged from 30-90 seconds, depending on the background noise pattern.

The dominant source of background noise observed during the tests was road traffic noise from distant roads.
4.0 EQUIPMENT

4.1 Environmental Noise Survey

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 971 Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

4.2 Breakout Assessment

The instrumentation used during noise breakout measurements is shown in Table 4.1 below.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Manufacturer and Type</th>
<th>Serial Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision integrating sound level meter &amp; analyser</td>
<td>01dB-Stell Black Solo</td>
<td>60587</td>
</tr>
<tr>
<td>Active Loudspeaker</td>
<td>RCF ART 310A</td>
<td>HAX20870</td>
</tr>
<tr>
<td>Active Loudspeaker</td>
<td>RCF ART 310A</td>
<td>GEX05725</td>
</tr>
<tr>
<td>White Noise Source</td>
<td>Acoustic Solutions – 513/4043</td>
<td>N/A</td>
</tr>
<tr>
<td>White Noise Source</td>
<td>Acoustic Solutions – 513/4043</td>
<td>N/A</td>
</tr>
<tr>
<td>Calibrator</td>
<td>Norsonic Type 1251</td>
<td>31716</td>
</tr>
</tbody>
</table>

Table 4.1 Instrumentation used during breakout measurements

The equipment calibration was verified before and after use and no abnormalities were observed.
5.0 RESULTS

5.1 Environmental Noise Survey

The $L_{Aeq}$, $L_{Amax}$, $L_{A10}$ and $L_{A90}$ acoustic parameters were measured and are shown as a time history in Figure 9477-TH1.

In order to protect the amenity of nearby noise sensitive receivers, minimum existing background noise levels have been calculated for proposed operational hours during the period of the survey.

Minimum measured background levels for these periods are shown in Table 5.1.

<table>
<thead>
<tr>
<th>Proposed Operating Hours (07:30-18:30)</th>
<th>37</th>
</tr>
</thead>
</table>

Table 5.1: Minimum background noise levels

5.2 Noise Breakout Levels

Summarised results of the noise breakout assessment and facade sound insulation performances are shown in Table 5.2. Breakout measurement locations are shown in 9477-SP1.

<table>
<thead>
<tr>
<th>Source</th>
<th>Receiver</th>
<th>Test Element</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Baby Room</td>
<td>Position 1</td>
<td>North facade comprising glazed elements</td>
<td>$D_w$ 41dB</td>
</tr>
<tr>
<td>Proposed Pre-School Room</td>
<td>Position 2</td>
<td>North facade comprising glazed elements</td>
<td>$D_w$ 40dB</td>
</tr>
<tr>
<td>Proposed Before and After School Club</td>
<td>Position 3</td>
<td>Glazed elements in south facade</td>
<td>$D_w$ 40dB</td>
</tr>
<tr>
<td></td>
<td>Position 4</td>
<td>Masonry parts of south facade</td>
<td>$D_w$ 42dB</td>
</tr>
</tbody>
</table>

Table 5.2 Sound insulation performance of tested elements
6.0 NOISE EMISSIONS CRITERIA

6.1 External Noise Emissions

In order to assess the likely impact of the proposed activities on nearby residential windows, we would suggest the comparison of anticipated noise emission levels to the minimum measured background noise levels \(L_{A90}\) and provide a rating of impact according to BS4142:1997: ‘Method for rating industrial noise affecting mixed residential and industrial areas’.

Although primarily used for assessing noise emissions of industrial activities, British Standard 4142:1997 can be seen as a good guide for assessing the suitability of noise emissions to residential receivers. In a BS4142 assessment, corrections are applied to measured noise levels in order to calculate a noise rating level for the effects of the source on nearby noise sensitive receivers.

This assessment will compare noise emissions to the operational hours minimum measured background noise level of 37 dB(A) during proposed operating hours.

In a BS4142 assessment, corrections are applied to measured noise levels in order to calculate a noise rating level for the effects of the source on nearby noise sensitive receivers. BS4142 states that a noise rating 5dB above the background noise level is of ‘marginal significance’. If the difference is of 10dB or more, then there is an indication that ‘complaints are likely’. A noise rating level of 10dB below the existing background noise is defined as ‘a positive indication that complaints are unlikely’.
7.0 DISCUSSION – EXTERNAL ACTIVITIES

7.1 Proposed Activity

There are two playground areas proposed; one to the north of the site and one to the west.

Previous measurements of playground activity on a similar site have been used in order to predict noise emissions to residential receivers. The measurements used were the loudest 5 minute period in a half hour playtime for 5 year olds. As the upper end of the age range for the proposed nursery attendees, an assessment of this age group will provide a robust assessment for the more active and louder children.

Manual measurements of the loudest period of outdoor play at a similar nursery are as shown in Table 7.1. It should be noted that with daytime noise rating levels based on a 1 hour period, assuming this loudest 5 minute period as constant will provide a particularly onerous assessment.

The noise levels shown in Table 7.1 were measured at source, with approximately 30 children playing in an outdoor play area.

<table>
<thead>
<tr>
<th>Source</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1kHz</th>
<th>2kHz</th>
<th>4kHz</th>
<th>8kHz</th>
<th>dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playground</td>
<td>63</td>
<td>57</td>
<td>56</td>
<td>61</td>
<td>64</td>
<td>68</td>
<td>62</td>
<td>51</td>
<td>71</td>
</tr>
</tbody>
</table>

Table 7.1: Measured Playground Noise Levels

These levels will be used to calculate the noise transmission to noise sensitive receivers.

For all calculated levels shown below, full formulae used and spectral calculations are shown in the corresponding Appendices B1A-B.

7.2 Noise Breakout Assessment – North Playground to Receiver 1

The main source of attenuation to noise emissions within the north playground will be the distance to the closest receiver [Receiver 1, at 25m]. A 1.8m high boundary fence will also be placed around the playground, which will provide a reasonable amount of attenuation to noise emissions.

Taking into account all necessary acoustic corrections, including a +5dB penalty for the distinguishable nature of proposed activities, the calculated receiver noise level is as shown in Table 7.2, with detailed calculations shown in Appendix B1A.
Table 7.2: Noise levels and background noise level at Receiver 1

As shown in Table 7.2 and Appendix B1A, transmission of noise to the nearest sensitive windows due to the effects of the proposed activity would provide a noise rating level of -3dB when compared to the minimum background noise level.

This would indicate that noise emissions due to proposed activity in the north playground are between the regions specified as ‘unlikely to cause complaints’ and ‘of marginal significance’ in accordance with BS4142.

We would therefore not expect a negative impact on the amenity of nearby residential receivers due to the north playground, considering that a particularly onerous assessment has been carried out.

It should also be noted that a +5dB penalty has been added to noise emissions, although this is strictly specified for industrial processes. Without this applied, the noise emissions would be comparable with the value specified as ‘unlikely to cause complaints’.

7.3 Noise Breakout Assessment – West Playground to Receiver 2

The main source of attenuation to noise emissions within the west playground will be the distance to the closest receiver [Receiver 2, at 20m]. A 1.8m high boundary fence will also be placed around the playground, which will provide a reasonable amount of attenuation to noise emissions.

Taking into account all necessary acoustic corrections, including a +5dB penalty for the distinguishable nature of proposed activities, the calculated receiver noise level is as shown in Table 7.3, with detailed calculations shown in Appendix B1B.

Table 7.3: Noise levels and background noise level at Receiver 2
As shown in Table 7.3 and Appendix B1B, transmission of noise to the nearest sensitive windows due to the effects of the proposed activity would provide a noise rating level of -1dB when compared to the minimum background noise level.

This would indicate that noise emissions due to proposed activity in the west playground are between the regions specified as ‘unlikely to cause complaints’ and ‘of marginal significance’ in accordance with BS4142.

We would therefore not expect a negative impact on the amenity of nearby residential receivers due to the west playground, considering that a particularly onerous assessment has been carried out.

It should also be noted that a +5dB penalty has been added to noise emissions, although this is strictly specified for industrial processes. Without this applied, the noise emissions would be comparable with the value specified as ‘unlikely to cause complaints’.

7.4 British Standard Requirements

Sections 7.2 and 7.3 demonstrate the calculated noise emission levels outside the nearest residential windows.

In order to further ensure the amenity of residential receivers, calculations will aim to assess whether the noise emissions from the proposed playgrounds would be expected to meet recognised British Standard recommendations for internal noise levels.

British Standard 8233:1999 ‘Sound insulation and noise reduction for buildings – Code of Practice’ gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:1999 recommends 30dB(A) as being ‘Good’ internal resting/sleeping conditions.

With external levels of 36 dB(A) at the most affected receiver (Receiver 2), the window itself would need to provide 6dB attenuation in order to meet ‘good’ conditions. According to BS8233:1999, a partially open window offers a minimum of 10dB attenuation.

It can therefore be predicted that noise emissions from the playgrounds would be expected to meet the most stringent recommendations for internal noise in accordance with BS8233:1999, even with neighbouring windows partially open. Detailed calculations are shown in Appendix B1.
8.0 DISCUSSION – INTERNAL ACTIVITIES

8.1 Proposed Activity

There are four main activity areas identified in the plans; the baby room, toddler room, pre-school room and the before and after school club. As the toddler room is in the centre of the building and as such has significant buffer zones to noise on either side, the assessment will focus on the three other spaces.

Proposed activities are expected to comprise learning, arts and crafts, music and singing and general play. In order to present a particularly onerous assessment, it will be assumed that indoor play noise levels could reach those previously measured in a nursery playground. Measurements in a similar nursery during an indoor music and singing session were significantly lower than those in the playground, so this will provide a robust assessment of internal activities.

The noise levels shown in Table 8.1 were measured at source, with approximately 30 children playing in an outdoor play area.

<table>
<thead>
<tr>
<th>Source</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1kHz</th>
<th>2kHz</th>
<th>4kHz</th>
<th>8kHz</th>
<th>dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playground</td>
<td>63</td>
<td>57</td>
<td>56</td>
<td>61</td>
<td>64</td>
<td>68</td>
<td>62</td>
<td>51</td>
<td>71</td>
</tr>
</tbody>
</table>

Table 8.1: Measured Playground Noise Levels

These levels will be used to calculate the noise transmission to noise sensitive receivers.

For all calculated levels shown below, full formulae used and spectral calculations are shown in the corresponding Appendices B2A-B.

The closest identified residential receivers are located at varying distances from the identified rooms as follows:

- Receiver 1, Located 30m from the weakest facade of the baby room,
- Receiver 1, Located 28m from the weakest facade of the toddler room,
- Receiver 3, Located 3m from the weakest facade of the before and after school club.

As Receiver 1 is located closest to both the baby and toddler rooms, the cumulative effects of these two spaces will be considered as shown below.
8.2 Noise Breakout Assessment – Receiver 1

The measured breakout points shown in Table 5.2 have been used to calculate breakout noise to Receiver 1.

With assumed play levels in both the baby and toddler rooms, noise emission levels at Receiver 1 due to noise breakout through the north facade would be as shown in Table 8.2.

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Minimum Operating Hours Background Noise Level L90</th>
<th>Noise Level at Receiver (due to indoor play)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver 1</td>
<td>37 dB(A)</td>
<td>10 dB(A)</td>
</tr>
</tbody>
</table>

Table 8.2: Noise levels and criteria at Receiver 1

In a BS4142 Assessment, corrections are applied to noise sources for tonal content. In this instance, since the noise source is music, a 5dB penalty has been applied in the calculations to account for the potentially distinguishable noise source.

As shown in Table 8.2 and Appendix B2A, transmission of noise to the nearest sensitive windows due to the effects of the proposed activity would provide a noise rating level of -27dB when compared to the minimum background noise level.

This would indicate that noise emissions due to indoor activities are closest to the region specified as ‘unlikely to cause complaints’ in accordance with BS4142. It is also unlikely that predicted indoor noise levels would be audible at Receiver 1.

8.3 Noise Breakout Assessment – Receiver 3

The weakest measured breakout point shown in Table 5.2 has been used to calculate breakout noise to Receiver 3.

With assumed play levels in the before and after school club, noise emission levels at Receiver 3 due to noise breakout through the south facade would be as shown in Table 8.3.

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Minimum Operating Hours Background Noise Level L90</th>
<th>Noise Level at Receiver (due to indoor play)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver 3</td>
<td>37 dB(A)</td>
<td>36 dB(A)</td>
</tr>
</tbody>
</table>

Table 8.3: Noise levels and criteria at Receiver 3
In a BS4142 Assessment, corrections are applied to noise sources for tonal content. In this instance, since the noise source is music, a 5dB penalty has been applied in the calculations to account for the potentially distinguishable noise source.

As shown in Table 8.3 and Appendix B2B, transmission of noise to the nearest sensitive windows due to the effects of the proposed activity would provide a noise rating level of -1dB when compared to the minimum background noise level.

This would indicate that noise emissions due to proposed activity in the before and after school club are between the regions specified as ‘unlikely to cause complaints’ and ‘of marginal significance’ in accordance with BS4142.

We would therefore not expect a negative impact on the amenity of nearby residential receivers due to the before and after school club, considering that a particularly onerous assessment has been carried out.

It should also be noted that a +5dB penalty has been added to noise emissions, although this is strictly specified for industrial processes. Without this applied, the noise emissions would be closer to the value specified as ‘unlikely to cause complaints’.

### 8.4 British Standard Requirements

Sections 8.2 and 8.3 demonstrate the calculated noise emission levels outside the nearest residential windows.

In order to further ensure the amenity of residential receivers, calculations will aim to assess whether the noise emissions from the proposed indoor activity would be expected to meet recognised British Standard recommendations for internal noise levels.

British Standard 8233:1999 ‘Sound insulation and noise reduction for buildings – Code of Practice’ gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:1999 recommends 30dB(A) as being ‘Good’ internal resting/sleeping conditions.

With external levels of 36 dB(A) at the most affected receiver (Receiver 3), the window itself would need to provide 6dB attenuation in order to meet ‘good’ conditions. According to BS8233:1999, a partially open window offers a minimum of 10dB attenuation.
It can therefore be predicted that noise emissions from indoor activities would be expected to meet the most stringent recommendations for internal noise in accordance with BS8233:1999, even with neighbouring windows partially open. Detailed calculations are shown in Appendix B2.

9.0 PROPOSED NOISE MANAGEMENT PLAN

In order to ensure the calculated noise emission levels are not exceeded, we would recommend following certain steps when operating the nursery, as detailed below:

- Children should be supervised at all times, with staff members mindful of surrounding residential properties,
- Windows should be kept closed where possible during periods of indoor activity,
- If possible, outdoor play areas should be used sparingly during early morning hours.

10.0 CONCLUSION

A noise survey has been undertaken at Falcon House, Whalley Road, Sabden, BB7 9DZ. The results of the survey, combined with noise breakout measurements, have enabled the assessment of noise propagation of proposed nursery activities to noise sensitive receivers.

Calculations have been based on peak periods of a previously measured nursery playtime.

Calculations have shown that the predicted noise due to nursery activities would meet the set noise criteria without the need for any further mitigation measures.

An outline noise management plan has been recommended, in order to minimise noise transmission due to other factors.

Report by
Duncan Martin MIOA

Checked by
Florian Clement MIOA
Indicative site plan showing noise monitoring position and nearest noise sensitive receivers

Date: 20 August 2014
Falcon House, Whalley Road, Sabden
Environmental Noise Time History
15 August 2014 to 18 August 2014

Level (dB re 2×10^−5 Pa)
**APPENDIX A**

**GLOSSARY OF ACOUSTIC TERMINOLOGY**

**dB(A)**

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear’s variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

**L_{eq}**

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level $L_{eq}$. The $L_{eq}$ is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

**L_{10}**

This is the level exceeded for not more than 10% of the time. This parameter is often used as a “not to exceed” criterion for noise.

**L_{90}**

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of “background noise” for environmental impact studies.

**L_{max}**

This is the maximum sound pressure level that has been measured over a period.

**Octave Bands**

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

**Addition of noise from several sources**

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.
Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

<table>
<thead>
<tr>
<th>Change in sound level (dB)</th>
<th>Change in perceived loudness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Imperceptible</td>
</tr>
<tr>
<td>3</td>
<td>Just barely perceptible</td>
</tr>
<tr>
<td>6</td>
<td>Clearly noticeable</td>
</tr>
<tr>
<td>10</td>
<td>About twice as loud</td>
</tr>
<tr>
<td>20</td>
<td>About 4 times as loud</td>
</tr>
</tbody>
</table>

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.
### APPENDIX B1

**9477**
Falcon House, Whalley Road, Sabden, BB7 9DZ

**Noise Transmission from Outdoor Activity**

**Appendix B1A**

Receiver: Receiver 1
Source: North Playground

<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>db(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measured Sound Pressure Level on a Playground</strong></td>
<td>63</td>
<td>57</td>
<td>56</td>
<td>61</td>
<td>64</td>
<td>68</td>
<td>62</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td>Distance correction to receiver, dB (25m)</td>
<td>-2</td>
<td>-4</td>
<td>-7</td>
<td>-11</td>
<td>-14</td>
<td>-15</td>
<td>-15</td>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>Screening of surrounding 1.8m high fence, dB</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Correction for tonal / distinguishable noise emissions</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Sound pressure level at receiver due to north playground</strong></td>
<td>38</td>
<td>30</td>
<td>26</td>
<td>27</td>
<td>27</td>
<td>30</td>
<td>24</td>
<td>13</td>
<td>34</td>
</tr>
</tbody>
</table>

**Minimum Measured Background Noise LA90** 37

**Difference between rating level and background** -3

---

**BS 8233 ASSESSMENT CALCULATION**

Receiver: Inside Receiver 1 Window
Source: North Playground

<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>db(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sound pressure level outside window</strong></td>
<td>38</td>
<td>30</td>
<td>26</td>
<td>27</td>
<td>27</td>
<td>30</td>
<td>24</td>
<td>13</td>
<td>34</td>
</tr>
<tr>
<td>Minimum attenuation from partially open window, dB</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td></td>
</tr>
<tr>
<td><strong>Sound pressure level inside nearest noise sensitive premises</strong></td>
<td>28</td>
<td>20</td>
<td>16</td>
<td>17</td>
<td>17</td>
<td>20</td>
<td>14</td>
<td>3</td>
<td>24</td>
</tr>
</tbody>
</table>

**Design Criterion** 30-35

continued over
**Appendix B1B**

**Receiver:** Receiver 2  
**Source:** West Playground

<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>dB(A)</th>
</tr>
</thead>
</table>

### Measured Sound Pressure Level on a Playground

<table>
<thead>
<tr>
<th>30 Children Playing</th>
<th>63</th>
<th>57</th>
<th>56</th>
<th>61</th>
<th>64</th>
<th>68</th>
<th>62</th>
<th>51</th>
<th>71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance correction to receiver, dB (20m)</td>
<td>-26</td>
<td>-26</td>
<td>-26</td>
<td>-26</td>
<td>-26</td>
<td>-26</td>
<td>-26</td>
<td>-26</td>
<td></td>
</tr>
<tr>
<td>Screening of surrounding 1.8m high fence, dB</td>
<td>-2</td>
<td>-4</td>
<td>-7</td>
<td>-11</td>
<td>-14</td>
<td>-15</td>
<td>-15</td>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>Correction for tonal / distinguishable noise emissions</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Sound pressure level at receiver due to west playground**  
| 40 | 32 | 28 | 29 | 29 | 32 | 26 | 15 | 36 |

### BS 8233 Assessment Calculation

**Receiver:** Inside Receiver 2 Window  
**Source:** West Playground

<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>dB(A)</th>
</tr>
</thead>
</table>

### Sound pressure level outside window

| 40 | 32 | 28 | 29 | 29 | 32 | 26 | 15 | 36 |

### Minimum attenuation from partially open window, dB

| -10 | -10 | -10 | -10 | -10 | -10 | -10 |

**Sound pressure level inside nearest noise sensitive premises**  
| 30 | 22 | 18 | 19 | 19 | 22 | 16 | 5 | 26 |

### Design Criterion

| 30-35 |
APPENDIX B1

9477
Falcon House, Whalley Road, Sabden, BB7 9DZ

Acoustic Calculation used for Indoor to Outdoor Transmission:

\[ SPL_{\text{outdoor}} = SPL_{\text{indoor}} - SRI_{\text{composite}} + 10 \log_{10} S + 10 \log\left(\frac{Q}{4\pi r^2}\right) - 6dB \]

Noise Transmission from Indoor Activity

<table>
<thead>
<tr>
<th>Appendix B2A</th>
<th>Receiver: Receiver 1</th>
<th>Source: Baby Room and Toddler Room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Sound Pressure Level in Baby Room</strong></td>
<td><strong>Frequency, Hz</strong></td>
<td>63</td>
</tr>
<tr>
<td>Indoor Play Noise Levels in Baby Room</td>
<td></td>
<td>63</td>
</tr>
<tr>
<td>Weakest measured transmission path (north facade), dB (SRI)</td>
<td></td>
<td>-21</td>
</tr>
<tr>
<td>Correction for total area of building facade (S = 24m²)</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Correction for directivity (Q) and distance (r) (Q=2, r = 30m)</td>
<td>-38</td>
<td>-38</td>
</tr>
<tr>
<td>Non reverberant correction</td>
<td>-6</td>
<td>-6</td>
</tr>
<tr>
<td>Correction for tonal / distinguishable noise emissions</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sound pressure level at receiver due to baby room</td>
<td>17</td>
<td>8</td>
</tr>
</tbody>
</table>

| **Internal Sound Pressure Level in Toddler Room** | **Frequency, Hz** | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Indoor Play Noise Levels in Toddler Room |            | 63 | 57 | 56 | 61 | 64 | 68 | 62 | 51 | 71 |
| Weakest measured transmission path (north facade), dB (SRI) |     | -20 | -24 | -28 | -35 | -44 | -44 | -44 | -44 |
| Correction for total area of building facade (S = 24m²) | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Correction for directivity (Q) and distance (r) (Q=2, r = 28m) | -37 | -37 | -37 | -37 | -37 | -37 | -37 | -37 |
| Non reverberant correction | -6 | -6 | -6 | -6 | -6 | -6 | -6 | -6 |
| Correction for tonal / distinguishable noise emissions | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Sound pressure level at receiver due to baby room | 19 | 9 | 4 | 2 | 0 | 0 | 0 | 0 | 8 |

Cumulative noise emission level at Receiver 1

| **Cumulative noise emission level at Receiver 1** | **Frequency, Hz** | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| **Design Criterion** |            | 21 | 12 | 6 | 4 | 3 | 3 | 3 | 3 | 10 |

Minimum Measured Background Noise LA90  37
Difference between rating level and background  -27

**BS 8233 ASSESSMENT CALCULATION**

<table>
<thead>
<tr>
<th>Receiver: Receiver 1</th>
<th>Source: Baby Room and Toddler Room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency, Hz</strong></td>
<td>63</td>
</tr>
<tr>
<td><strong>Sound pressure level outside window</strong></td>
<td>21</td>
</tr>
<tr>
<td>Minimum attenuation from partially open window, dB</td>
<td>-10</td>
</tr>
<tr>
<td>Sound pressure level inside nearest noise sensitive premises</td>
<td>11</td>
</tr>
</tbody>
</table>

Design Criterion  30-35

continued over
## Appendix B2B

**Receiver:** Receiver 3  
**Source:** Before and After School Club

### Internal Sound Pressure Level in Before and After School Club

<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indoor Play Noise Levels in Before and After School Club</strong></td>
<td>63</td>
<td>57</td>
<td>56</td>
<td>61</td>
<td>64</td>
<td>68</td>
<td>62</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td><strong>Weakest measured transmission path (glazed elements), dB (SRI)</strong></td>
<td>-21</td>
<td>-25</td>
<td>-30</td>
<td>-37</td>
<td>-37</td>
<td>-44</td>
<td>-45</td>
<td>-45</td>
<td></td>
</tr>
<tr>
<td><strong>Correction for total area of building facade (S = 120m²)</strong></td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td><strong>Non reverberant correction</strong></td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
<td></td>
</tr>
<tr>
<td><strong>Correction for tonal / distinguishable noise emissions</strong></td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Sound pressure level at receiver due to Before and After School Club**  
<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>37</td>
<td>31</td>
<td>29</td>
<td>32</td>
<td>29</td>
<td>22</td>
<td>11</td>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>

### Minimum Measured Background Noise LA90  
37 dB

### Difference between rating level and background  
-1 dB

### BS 8233 ASSESSMENT CALCULATION

**Receiver:** Receiver 3  
**Source:** Before and After School Club

<table>
<thead>
<tr>
<th>Frequency, Hz</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
<th>dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sound pressure level outside window</strong></td>
<td>47</td>
<td>37</td>
<td>31</td>
<td>29</td>
<td>32</td>
<td>29</td>
<td>22</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td><strong>Minimum attenuation from partially open window, dB</strong></td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td></td>
</tr>
<tr>
<td><strong>Sound pressure level inside nearest noise sensitive premises</strong></td>
<td>37</td>
<td>27</td>
<td>21</td>
<td>19</td>
<td>22</td>
<td>19</td>
<td>12</td>
<td>1</td>
<td>26</td>
</tr>
</tbody>
</table>

### Design Criterion  
30-35 dB