



## BRAIDEN ACOUSTICS LTD

Innovation Forum // 51 Frederick Road // Salford // Manchester // M6 6FP

### NOISE IMPACT ASSESSMENT - RESIDENTIAL

Prepared For : Studio Tashkeel Architecture

Date : 3 Jun 2024

Site : Land At Junction Of Brogan Street And Garlick Street,  
Gorton

Report No. : 11263

## 1 INTRODUCTION

Braiden Acoustics has been commissioned by Studio Tashkeel Architecture to undertake an acoustic survey at the site at Land At Junction Of Brogan Street And Garlick Street, Gorton in order to support planning application 136470/FO/2023 which proposes: "Erection of 1 pair of two storey semi-detached dwellinghouses (Class C3) incorporating rear roof dormer, together with associated landscaping and boundary treatment".

Condition 11 of the Decision Notice states:

11)

*a) Before occupation of the development, a scheme shall be submitted to and approved in writing by the City Council as local planning authority relating to the acoustic insulation of the residential accommodation against noise from retail / commercial uses and traffic along Wellington Street and any other identified noise sources within the vicinity of the application site. The approved noise insulation scheme shall be implemented before the development is occupied.*

*b) Prior to first occupation of the residential units, a verification report shall be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the internal noise criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the internal noise criteria.*

*Reason - To secure appropriate noise attenuation and in order to protect future residents from noise nuisance, pursuant to policies SP1, H1 and DM1 of the Core Strategy for the City of Manchester and saved policy DC26 of the Unitary Development Plan.*

Condition 11 is in two -parts:

- a) Noise Impact Assessment to ensure that the building is designed so that it is suitably protected from environmental noise and
- b) Verification Report when the dwellings are built, but before first occupation, to ensure internal noise levels are adequate.



### 1.1 AIM

The aim of the report is to describe the site and its surroundings with regards to potential noise sources and receivers related to the site. Where suitable, acoustic mitigation measures will be recommended so that relevant noise standards and guidelines are adhered to.

## 2 DESCRIPTION OF SITE

The site is an empty parcel of land that was once a small chapel.



Figure 1  
Street view of site

### 2.1 SITE LOCATION AND NEIGHBOURING USES

The site is bounded by Garlick Street to the south and Brogan Street to the east. Directly to the rear (west) is some hardstanding and directly to the north is a residential dwelling on Brogan Street.



Figure 2  
Site location and surrounding uses

#### 2.1.1 Wider area

Further to the west, by some 200m is a Tesco superstore.



Hyde Road is approximately 120m to the south west where there is potential for direct line of sight.

The Plough public house is 100m to the south west, although there is no direct line of sight.

Further to the north and east of the site is primarily residential in use.



Figure 3  
Site in relation to wider surrounding area

2.2 PROPOSED USE

It is proposed to erect a pair of semi-detached 2 ½ storey residential dwellings as shown below.

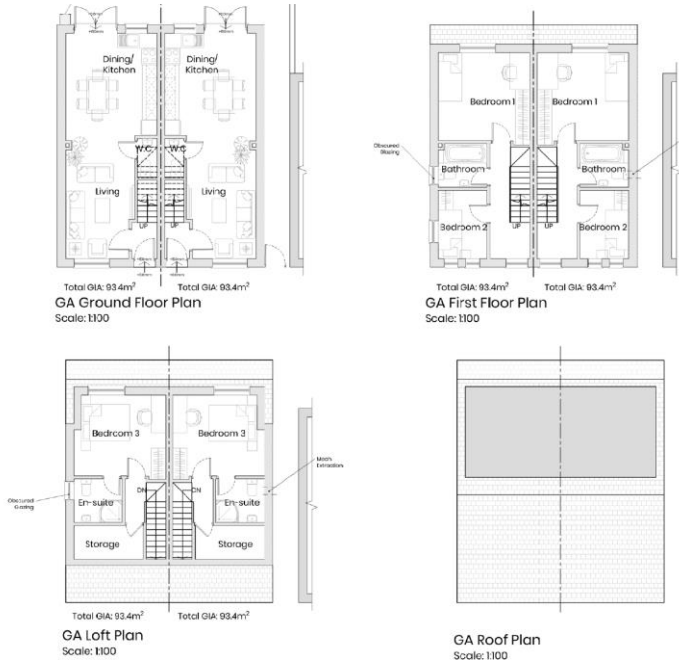
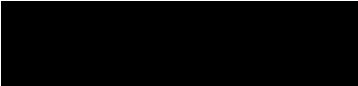


Figure 4  
Proposed floor plans



### 3 ACOUSTIC CRITERIA AND METHODOLOGY

This is a residential development that may be susceptible to environmental noise, such as road traffic noise and/or noise from local industry. Recommended noise levels due to environmental noise are taken from BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” [1] which, in turn, takes guidance from the research based World Health Organisation “Guidelines for Community Noise”. Where necessary, mitigation measures have been recommended so that the noise level thresholds are not breached.

Noise levels are usually given separately for the night-time – 2300-0700 hrs and day time – 0700-2300 hrs.

#### 3.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

The National Planning Policy Framework is the current document for planning guidance. Paragraph 123 of the NPPF says that planning decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum, other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

#### 3.2 BS 8233: 2014

The British Standard BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” gives guidance on recommended indoor ambient noise levels for residential dwellings.

| Room             | Criterion | $L_{Aeq,T}$ |     |
|------------------|-----------|-------------|-----|
|                  |           | night       | day |
| Bedroom          | Sleeping  | 30          | 35  |
| Dining Room/Area | Dining    | --          | 40  |
| Living Room      | Resting   | --          | 35  |

Table 1

Recommending indoor ambient noise level thresholds from anonymous noise (taken from Table 4, BS 8233:2014)

*NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.*

Internal noise levels in habitable rooms are calculated using either the simple or rigorous method as described in Annex G in BS 8233:2104.



### 3.2.1 Noise levels in external living areas

For external living areas such as gardens and balconies, BS 8233:2014 § 7.7.3.2 recommends an upper limit of 55dB  $L_{Aeq,day}$  although there is a caveat:

*However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*

### 3.2.2 Maximum noise levels

In the 2014 edition of the Standard, the criterion of 45dB  $L_{AFMax}$  inside bedrooms has been removed although there is Note 4:

*NOTE 4 regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or  $L_{Amax,P}$  depending on the character and number of events per night. Sporadic noise events could require separate values.*

The use of the phrases ‘may be set’ and ‘could require’ imply that this is a discretionary criterion.

The  $L_{Amax}$  criterion is used where the level is not exceeded more than 10 times during the night time period.

### 3.3 BS 4142

BS 4142:1999 “Method for rating industrial noise affecting mixed residential and industrial areas” [2] assesses industrial noise with regards to nearby residential dwellings. The guidance is commonly used to compare the equivalent noise from an industrial source only (specific noise level),  $L_{Aeq}$ , to the background noise level,  $L_{A90}$ , at the nearest sensitive receptor (NSR).

When measuring the Background Noise Level, the Standard states:

*Choose outdoor measurement locations that will give results that are representative of the ambient sound and residual sound at the assessment location(s). Make the measurement of the ambient sound level, the residual sound level and the background sound level at a height of 1.2 m to 1.5 m above the ground, unless there is a specific reason to use an alternative height (which should be justified), and under similar conditions, e.g. similar influence of reflections and measurement height above the ground. Where practical, minimize the influence of reflections by making the measurements at least 3.5 m from any reflecting surface other than the ground.*

*Where it is necessary to undertake measurements above ground floor level, choose a location which is approximately 1 m from the facade on the relevant floor of the building if it is not practical to make the measurements at least 3.5 m from the facade at this elevation. NOTE When measurements for distant sources are made at 1 m from a facade, the measured level can be adjusted to an equivalent free-field level by subtracting a 3 dB correction factor. For sources that are relatively close or not perpendicular to the facade the correction may be 1 dB or 2 dB, in which case the reasons for not using a correction of 3 dB ought to be explained.*

Essentially, background noise measurement should be made free field. If measurements are made at the façade then a correction should be made in order to represent the free field.

This Standard has been recently updated, BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” [3]. Whereas the old standard added 5dB ‘penalty’ to the Specific Noise Level (SNL) if the noise source has a ‘character’ that can draw attention that may be described as tonal, intermittent or impulsive, the new standard gives clearer guidance on noise ‘character’. Furthermore, the previous Standard gave only one 5 dB penalty whereas the new Standard may not. When added to the specific noise level it forms the rating level. The new Standard gives the guidance for the following types of noise character:



Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.

*NOTE 1 The prominence of tonal or impulsive sound from a source can be masked by residual sound. In many cases the amount of masking varies as the residual sound changes in level and possibly character. The source's tonal and/or impulsive characteristics could also vary with time.*

Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention.

#### Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

#### Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

#### Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

*NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.*

#### Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Once a penalty for noise character is added to the Specific Noise Level then this is termed the Rating Level.

The background level is then compared to the rating level. It is usual that the rating level due to the source should be below the background noise level at the nearest sensitive receptor; indeed BS 4142 states:

*“The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.”*

## 1.1 BRITISH / INTERNATIONAL STANDARDS

### 1.1.1 BS ISO EN 140 / 717

The 140 series of standards “Acoustics — Measurement of sound insulation in buildings and of building elements” describes the various methods of measuring the sound insulation of a multitude of building element types. The 717 series then describes the calculations to determine many different types of acoustic descriptors, especially the single number ‘weighted’ value.



The currently methodology for the assessment of sound insulation within a building is taken from The Building Regulations Part E: Resistance to the Passage of Sound, otherwise known as Approved Document E (ADE). The testing procedure is described in Annex B with reference to ISO 140-4 [4], ISO 140-7 [5], ISO 717-1 [6] and ISO 717-2 [7] which describe the testing methodology for airborne and structure borne noise as well as descriptions of the various relevant parameters and nomenclature.

The dwellings within the proposed site are classed as flats and so fall under the directions of part E1 of the Building Regulations document [Error! Bookmark not defined.].

*E1. Dwelling houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.*

According to Building Regulations Approved Document E (ADE) the proposed developed comes under the category material change of use, in other words the development is a a new build.

| Performance standard for separating walls and floors              | Sound Insulation Requirement |                  |
|-------------------------------------------------------------------|------------------------------|------------------|
|                                                                   | $D_{nT,w} + C_{tr}$ (dB)     | $L'_{nT,w}$ (dB) |
| <b>Dwelling-houses and flats formed by material change of use</b> |                              |                  |
| Walls                                                             | $\geq 43$                    | -                |
| Floors                                                            | $\geq 43$                    | $\leq 64$        |
| <b>Purpose built dwelling-houses and flats</b>                    |                              |                  |
| Walls                                                             | $\geq 45$                    | -                |
| Floors                                                            | $\geq 45$                    | $\leq 62$        |

Table 2  
Tables 0.1a from Approved Document E

Separating walls and floors must meet the requirements given in Building Regulation Part E. The testing requirements between separating partitions are shown in Figure 5.

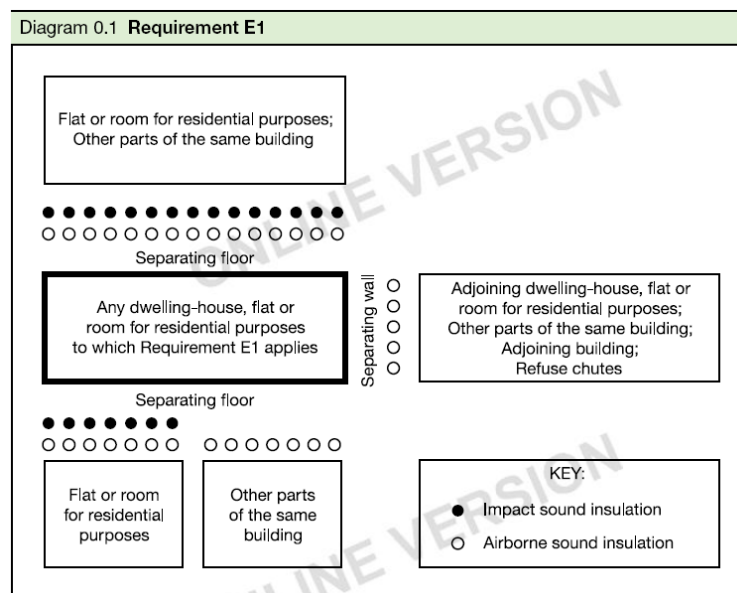


Figure 5  
Diagram 0.1 from Approved Document E



Figure 5 shows that there should be both airborne and impact sound insulation tests of the separating floors and airborne for the separating walls.

### 3.4 COUNCIL CRITERIA

#### 3.4.1 Residential Developments

It is usual for councils to adopt the following internal noise limits for residential properties:

- **Bedrooms**
  - **30 dB LAeq (night time - 23.00 - 07.00)**
  - **45 dB LAmax,F (individual noise events should not normally exceed by more than 15 times)**
- **Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq**
- **Gardens and terraces (daytime - 07.00 - 23.00) 55 dB LAeq**

## 4 MONITORING DETAILS

### 4.1 MONITORING OVERVIEW

Personnel: John Braiden, BSc & MSc Acoustics, MIOA.

Equipment: NTi XL2 integrated real time analyser & B&K 4231 calibrator.

Weather: 4- 8degC, <5m/s wind, 40-60% cloud

Time / Date: Thursday 22<sup>nd</sup> 22/02/2024 16:46:14 for over 24 hours.

The sound level meter was calibrated before after the measurements with no drift reported.

Monitoring was unmanned.

Background noise ( $L_{A90}$ ), 'average' noise levels ( $L_{Aeq}$ ) and maximum noise levels ( $L_{Amax}$ ) were taken in 15-minute intervals.

### 4.2 MONITORING LOCATION

The monitoring location was at 1.5m from ground floor level at the western edge of the site.

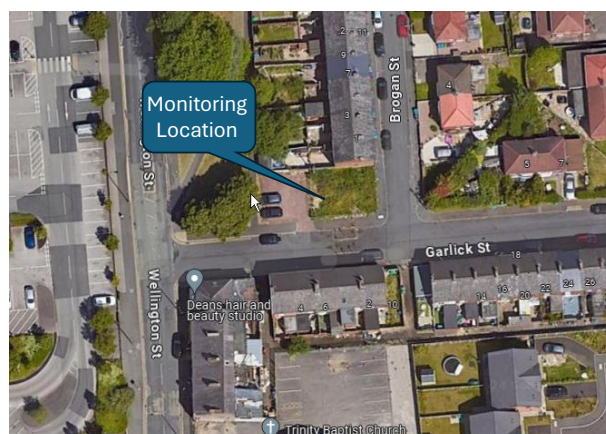


Figure 6  
Monitoring location



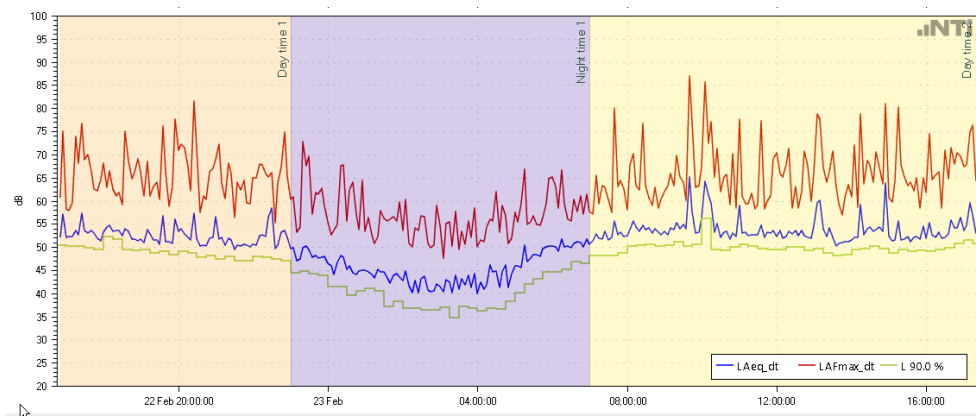


Figure 7  
Time history

The noise level on site was dominated by road traffic noise from Hyde Road to the south west. There were some infrequent vehicular movements on the local road of Garlick and Brogan Street.

There was no industrial noise detected at the monitoring location.

| Day       | Time     |          | Duration | Time Period | $L_{A90}$<br>dB | $L_{Aeq}$<br>dB | $L_{Amax}$<br>dB |
|-----------|----------|----------|----------|-------------|-----------------|-----------------|------------------|
|           | Start    | Finish   |          |             |                 |                 |                  |
| Thurs/Fri | 16:16:44 | 23:00:00 | 06:43:16 | day         | 48.4            | 53.0            | 81.6             |
|           | 23:00:00 | 07:00:00 | 08:00:00 | night       | 37.8            | 46.8            | 72.8             |
|           | 07:00:00 | 14:45:13 | 07:45:13 | day         | 49.5            | 55.0            | 87.0             |

Table 3  
Summary of noise monitoring results

The fact that the night time noise levels were relatively modest for a Thursday night, reveals that the any late-night nearby commercial establishments do not have an impact on the site.

The overall free field noise levels are as follows:

$L_{Aeq}$  (night) 47 dB(A)

$L_{Aeq}$  (day) 54 dB(A)

#### 4.2.1 Maximum levels

For maximum levels, Section 3.4.1 states:

*45 dB  $L_{Amax,F}$  (individual noise events should not normally exceed by more than 15 times)*

Therefore, it was necessary to find a level that was not breached more than 15 times during the nighttime period.

Figure 8 shows that 62 dB  $L_{Amax}$  was not exceeded more than 15 times during the night time.



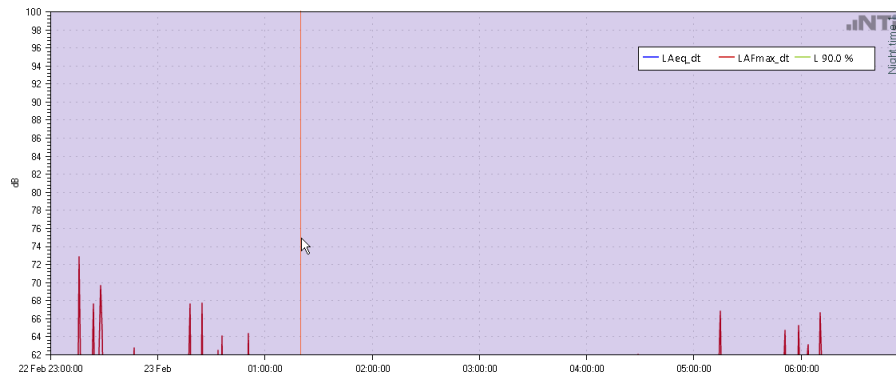


Figure 8  
Max levels not breached more than 15 times during the night-time

The free field max noise levels are as follows:

$L_{Amax, <15}$  (night)                      62 dB(A)

## 5 ACOUSTIC ASSESSMENT

### 5.1 ENVIRONMENT NOISE BREAK IN

Given the external noise levels, the initial glazing scheme can be suggested. However, it should be noted that this assumes windows closed in order to achieve the internal noise levels based on BS 8223.

The amount of attenuation from the building façades were readily computed using the simple method in Appendix G of BS 8233:2014 whereby the sound insulation index (SRI) of the glazing (the weakest element of the building façade, acoustically) is determined by simply deducting the required internal noise level from the external free field noise level.

#### 5.1.1 Façade effect

A -3dB façade correction was not necessary as the noise monitoring was free-field.

#### 5.1.2 Distance correction

There was no distance correction applied as the monitoring location was placed at the nearest façade.

#### 5.1.3 Barrier effect

There is no barrier correction due to direct line of sight to the noise sources for the facades / windows facing Burnage Lane.

The measured noise levels have been attributed to all elevations.

#### 5.1.4 BS 8233 assessment

The weakest structural element is the glazing. The required glazing was calculated using recommended internal values. The Table below shows the required Sound Reduction Indices (SRI) for the bedrooms (night) and living areas (day) on each relevant elevation.



| Façade | period | room    | External Levels<br>measured / calc'd |                    | Internal Levels<br>recommended |                    | Required glazing          |                       |
|--------|--------|---------|--------------------------------------|--------------------|--------------------------------|--------------------|---------------------------|-----------------------|
|        |        |         | $L_{Aeq}$<br>(dB)                    | $L_{Amax}$<br>(dB) | $L_{Aeq}$<br>(dB)              | $L_{Amax}$<br>(dB) | SRI<br>( $R_w + C_{tr}$ ) | Example Spec          |
| ALL    | night  | bedroom | 47                                   | 62                 | 30                             | 45                 | 17                        | 4 (16) 4 <sup>1</sup> |
|        | day    | lounge  | 54                                   |                    | 35                             |                    | 19                        | 4 (16) 4 <sup>2</sup> |

Table 4  
Calculated SRI values and recommended glazing

Glazing for habitable rooms only require standard double glazing, as per Table 4.

## 5.2 GARDENS

The rear boundary treatment should be a close-boarded timber fence at least 1.8 m high and with a surface density of at least 10kg/m<sup>2</sup>.

## 5.3 VENTILATION

Due to modest noise levels, adequate ventilation via open windows will not raise internal noise levels excessively. Therefore, no alternative ventilation is required.

# 6 CONCLUSION

An acoustic survey has taken place at Land At Junction Of Brogan Street And Garlick Street, Gorton to support a planning application for the erection of residential dwellings.

Environmental noise was surprisingly modest. There was no discernible influence from any late-night establishments; thus the predominating noise source was road traffic noise.

There were no local industrial noise sources affecting the site.

**Standard double glazing will achieve adequate internal noise levels around the development.**

Open windows will provide ventilation without increasing internal noise levels above the recommended thresholds.

# 7 REFERENCES

[1] BS8233: 2014

*Guidance on sound insulation and noise reduction for buildings*

British Standards Institute, 2014.

[2] BS 4142: 1997

*Method for Rating industrial noise affecting mixed residential and industrial areas*

British Standards Institute, 1997.

<sup>1</sup> Example glazing build up and performance from BS 12354-3 – table in Appendix. Other glazing build-ups available.

<sup>2</sup> Example glazing build up from Saint Gobain.



- [3] BS 4142: 2014  
*Methods for rating and assessing industrial and commercial sound*  
British Standards Institute, 2014.
- [4] BS EN ISO 140-4:1998  
*Acoustics. Measurement of sound insulation in buildings and of building elements. Field measurements of airborne sound insulation between rooms*  
British Standards, 1998.
- [5] BS EN ISO 140-7:1998  
*Acoustics. Measurement of sound insulation in buildings and of building elements. Field measurements of impact sound insulation of floors*  
British Standards, 1998.
- [6] BS EN ISO 717-1:1997  
*Acoustics. Rating of sound insulation in buildings and of building elements. Airborne sound insulation*  
British Standards, 1997.
- [7] BS EN ISO 717-2:1997  
*Acoustics. Rating of sound insulation in buildings and of building elements. Impact sound insulation*  
British Standards, 1997.



## Appendix

### A1 BS12354-3 – Glazing spec

**Table B.1 - Examples of the sound reduction index of glazing**

| Glazing type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Sound reduction index (dB) |        |        |       |       |       |                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------|--------|-------|-------|-------|-------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 125 Hz                     | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | $R_w$ (C; $C_{tr}$ ) dB |
| <b>Single panes (mm)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                            |        |        |       |       |       |                         |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 14                         | 19     | 25     | 29    | 33    | 25    | 28 (-1; -4)             |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 17                         | 20     | 26     | 32    | 33    | 26    | 29 (-2; -3)             |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 19                         | 22     | 29     | 33    | 29    | 31    | 30 (-1; -2)             |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 18                         | 23     | 30     | 35    | 27    | 32    | 31 (-2; -3)             |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 20                         | 24     | 29     | 34    | 29    | 37    | 32 (-2; -3)             |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 23                         | 26     | 32     | 31    | 32    | 39    | 33 (-2; -3)             |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 27                         | 29     | 31     | 32    | 38    | 47    | 34 (0; -2)              |
| <b>Laminated panes (mm) + plastic laminate (0,5 to 1) mm</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |        |        |       |       |       |                         |
| 6+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 20                         | 23     | 29     | 34    | 32    | 38    | 32 (-1; -3)             |
| 8+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 20                         | 25     | 32     | 35    | 34    | 42    | 33 (-1; -3)             |
| 10+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 24                         | 26     | 33     | 33    | 35    | 44    | 34 (-1; -3)             |
| <b>Double pane units with single or laminated panes (mm); air filled cavity from (6 to 16) mm</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |        |        |       |       |       |                         |
| 4-(6-16)-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 21                         | 17     | 25     | 35    | 37    | 31    | 29 (-1; -4)             |
| 6-(6-16)-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 21                         | 20     | 26     | 38    | 37    | 39    | 32 (-2; -4)             |
| 6-(6-16)-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 20                         | 18     | 28     | 38    | 34    | 38    | 31 (-1; -4)             |
| 8-(6-16)-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 22                         | 21     | 28     | 38    | 40    | 47    | 33 (-1; -4)             |
| 8-(6-16)-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 20                         | 21     | 33     | 40    | 36    | 48    | 35 (-2; -6)             |
| 10-(6-16)-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 24                         | 21     | 32     | 37    | 42    | 43    | 35 (-2; -5)             |
| 10-(6-16)-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 24                         | 24     | 32     | 37    | 37    | 44    | 35 (-1; -3)             |
| 6-(6-16)-6+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 20                         | 19     | 30     | 39    | 37    | 46    | 33 (-2; -5)             |
| 6-(6-16)-10+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 24                         | 25     | 33     | 39    | 40    | 49    | 37 (-1; -5)             |
| <p>NOTE 1 This selection and the values are in accordance with prEN 12758-1. The single number ratings are deduced from results in 1/3-octave bands and therefore single number ratings deduced from the given octave band data might result in values which differ 1 dB at the most.</p> <p>NOTE 2 Though it is known that for a given double pane unit the sound reduction increases with increasing cavity width, this effect has been found to be too small to take into account here for air filled cavities in the light of the inherent spread in results for nominally identical units.</p> |                            |        |        |       |       |       |                         |

