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**MR NURUL HAQUE**

**NOISE IMPACT ASSESSMENT REPORT**

**55 SLACK ROAD, MANCHESTER M9 8NJ**

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Client: Mr Nurul Haque

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| P6558-R1-V1        | 23/07/23 | M. J. Malone, MIOA                                                                   | M. J. Malone, MIOA                                                                    |
|                    |          |  |  |

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## APPENDICES

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## 1 INTRODUCTION

- 1.1.1 By instruction from Mr Nurul Haque ('the client'), NoiseAir was commissioned to undertake a noise impact assessment (NIA) for a proposed residential development at 55 Slack Road, Manchester M9 5NJ herein referred to as the 'development site'.
- 1.1.2 This noise report has been prepared to discharge Condition 4a of granted planning decision ref: 134434/FO/2022, and assesses the results of a noise survey carried out in accordance with current guidance and includes recommendations and mitigation as appropriate.
- 1.1.3 General limitations of this report are outlined in **Appendix A**.

### 1.2 Planning Condition

- 1.2.1 The granted planning condition 4a (ref: 134434/FO/2022) has been reproduced below to which this report relates:

*4) a) Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Slack Road shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The approved noise insulation scheme shall be completed before any of the dwelling units are occupied.*

*Noise survey data must include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The following noise criteria will be required to be achieved:*

*Bedrooms (night time - 23.00 - 07.00) 30 dB L Aeq (individual noise events shall not exceed 45 dB L Amax,F by more than 15 times) Living Rooms (daytime - 07.00 - 23.00) 35 dB L Aeq Gardens and terraces (daytime) 55 dB L Aeq."*

### 1.3 Site Description

- 1.3.1 The development site is a vacant parcel of land located within a predominantly residential, suburban area of northern Manchester.
- 1.3.2 The development site fronts onto Slack Road.

- 1.3.3 **Figure 1** shows an aerial photograph of the development site with respect to the local area and its context.



**Figure 1: Site aerial photograph.**

#### 1.4 Development Proposals

- 1.4.1 Proposals for the development site outline the erection of two storey, detached dwellinghouse (Class C3) with associated parking, landscaping and boundary treatment.
- 1.4.2 The proposed site layout is presented in **Figure 2, FIGURE** and **FIGURE** below.

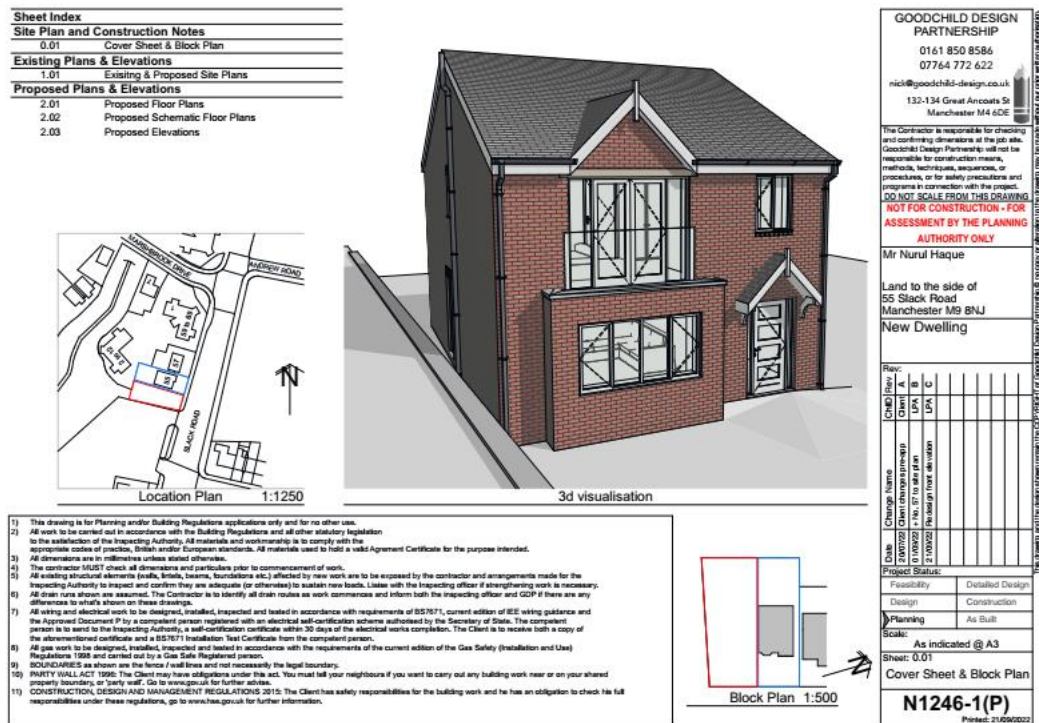




Figure 4: Proposed Site Layout.

## 2 ACOUSTIC SURVEY

### 2.1 Acoustic Survey Details

- 2.1.1 NoiseAir carried out fixed position noise monitoring between 15<sup>th</sup> July 2023 to 18<sup>th</sup> July 2023 at the development site.
- 2.1.2 Noise monitoring was undertaken at one monitoring location (ML1), the monitoring position is shown in **Figure 5** and detailed in **Table 1** below.



**Figure 5: Site layout plan and noise monitoring locations.**

| Table 1: Summary of Noise Monitoring Location |                                                                                                                                                                           |                       |                   |                                   |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------|-----------------------------------|
| Monitor Location Number                       | Location Description                                                                                                                                                      | Time Period Monitored |                   | Attended or Unattended Monitoring |
|                                               |                                                                                                                                                                           | Start                 | End/ Duration     |                                   |
| ML1                                           | The sound level meter microphone was located in the rear garden of 55 Slack Road. The microphone was positioned at 1.5 m above ground level and in free field conditions. | 15:00<br>15/07/23     | 11:15<br>18/07/23 | Unattended                        |

- 2.1.3 The monitor location was positioned to be representative of the noise levels at the approximate location of the development site and so data from this location will be used for the calibration of a 3D sound model.
- 2.1.4 The noise measurements were made using one Class 1, integrating sound level meter (SLM).

2.1.5 The acoustic equipment was calibrated to comply with Section 4.2 of BS7445-1:2003<sup>1</sup> before and after the noise monitoring periods.

2.1.6 Details of the SLM and associated field calibration can be found in **Table 2** below;

| Table 2: Summary of SLM's used for survey and associated field calibration |                        |                            |                            |                   |                 |        |
|----------------------------------------------------------------------------|------------------------|----------------------------|----------------------------|-------------------|-----------------|--------|
| SLM (Serial Number)                                                        | Preamp (Serial Number) | Microphone (Serial Number) | Calibrator (Serial Number) | Start Calibration | End Calibration | Drift  |
| NOR140 (1402868)                                                           | NOR1209 (12172)        | NOR1225 (79633)            | B&K 4231 (2482550)         | -26.4 dB          | -26.5 dB        | 0.1 dB |

2.1.7 The weather conditions were noted to be as outlined in **Table 3** during the site visits at the start and end of the monitoring periods.

| Table 3: Summary of weather conditions noted at the start and end of the monitoring duration. |                            |                            |
|-----------------------------------------------------------------------------------------------|----------------------------|----------------------------|
|                                                                                               | 15 <sup>th</sup> July 2023 | 18 <sup>th</sup> July 2023 |
| Roads (Wet / Dry)                                                                             | Dry                        | Dry                        |
| Temperature (°C)                                                                              | 18                         | 16                         |
| Wind speed (ms <sup>-1</sup> )                                                                | < 5                        | < 5                        |
| Cloud Cover (Approx. %)                                                                       | 100                        | 40                         |
| Humidity (%)                                                                                  | 66                         | 72                         |

2.1.8 A-weighted<sup>2</sup> L<sub>eq</sub><sup>3</sup> and L<sub>AMax</sub><sup>4</sup> noise levels were measured to comply with the requirements of the planning condition. A-weighted L<sub>90</sub><sup>5</sup> were also measured to provide additional information.

2.1.9 Attending the development site at the start and end of the survey monitoring period provided opportunity for observations and detailed notes to be made of the significant noise sources which contribute to each of the measured levels.

## ML1

<sup>1</sup> BS7445-2003 "Description and measurement of environmental noise – Part 1: Guide to quantities and procedures.

<sup>2</sup> An electronic filter in a sound level meter which mimics the human ear's response to sounds at different frequencies under defined conditions.

<sup>3</sup> Equivalent continuous noise level; the steady sound pressure which contains an equivalent quantity of sound energy as the time-varying sound pressure levels.

<sup>4</sup> The instantaneous maximum noise level recorded for a measurement period.

<sup>5</sup> The noise level which is exceeded for 90% of the measurement period.

**Road Traffic Noise from Slack Road:** Regular vehicle noise was audible at ML1 from vehicles passing.

## 2.2 Measured Sound Levels – Noise Monitoring (ML1)

2.2.1 Data is shown in **Figure 6** detailing a level vs. time graph of the recorded  $L_{Amax}$ ,  $L_{Aeq}$  and  $L_{A90}$  sound level over 15-minute time periods for ML1.

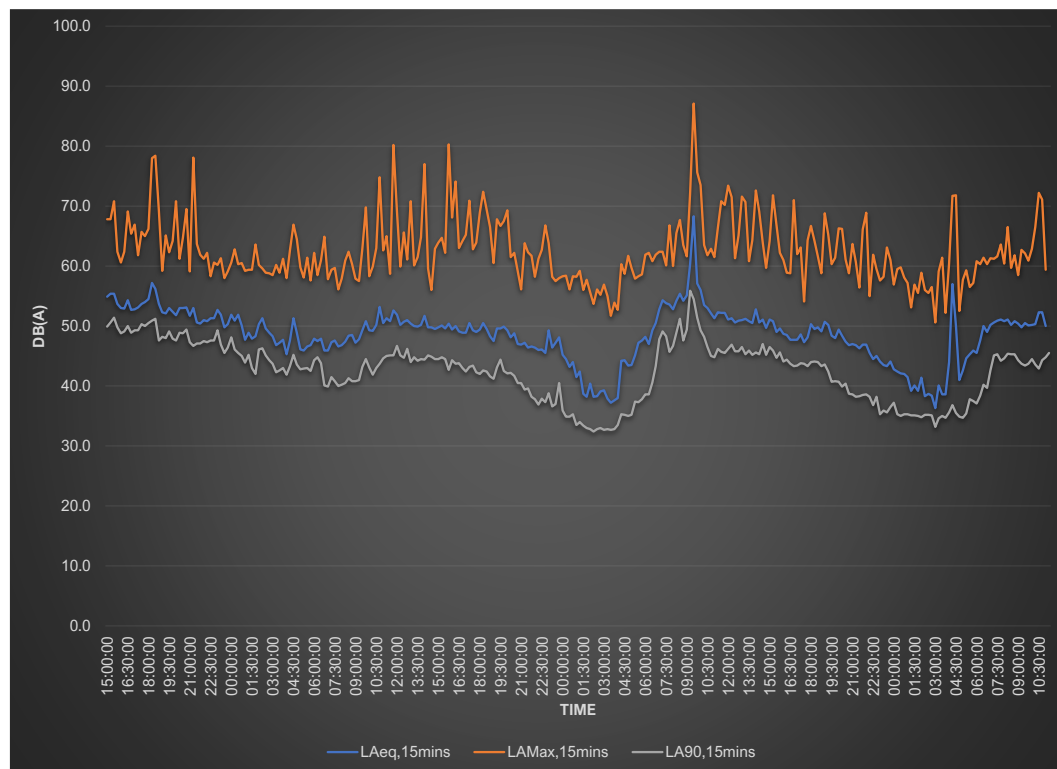


**Figure 6: Level vs. time graph showing  $L_{Amax}$ ,  $L_{Aeq}$  and  $L_{A90}$  sound levels – ML1.**

2.2.2 The results for monitoring locations ML1 during the daytime and night-time periods are presented in **Table 4**. It was noted during the survey that some construction noise was present during the working daytime hours and therefore this timeframe has been removed from the dataset.

| Table 4: Average Measured Daytime and Night-time Noise Levels                                                                                                                                                         |             |                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------|
| Monitoring Location                                                                                                                                                                                                   | Time        | Measured Noise Level                     |
|                                                                                                                                                                                                                       |             | dB $L_{Aeq,16hour}$ / dB $L_{Aeq,8hour}$ |
| ML1                                                                                                                                                                                                                   | 07:00-23:00 | 49.4 – 54.0*                             |
|                                                                                                                                                                                                                       | 23:00-07:00 | 45.0 – 49.2                              |
| * 16 hour time period (note that some measurements were not made over the entire period, however an appropriate proportion of this period was included such that a typical / conservative noise climate was derived). |             |                                          |

2.2.3 The maximum noise level exceeded more than 10 times in one night-time period is summarised in **Table 5**.

| Table 5: Summary of the Maximum Noise Level Exceeded More than 10 Times in One Night-time Period (Figures in dB $L_{Amax}$ ). |                          |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Monitoring Location                                                                                                           | Maximum Noise Level (dB) |
| ML1                                                                                                                           | 61                       |

### 3 3D SOUND MODEL

#### 3.1 Introduction

3.1.1 In order to accurately undertake an NIA with respect to the development proposals, it is considered that a 3D sound model should be utilised to calculate the noise levels at identified receptor locations.

#### 3.2 3D Sound Model

3.2.1 A 3D sound model has been constructed in SoundPLAN™ to calculate the predicted sound pressure levels at selected potential receptor locations. The model uses the calculation method from ISO 9613-2:1996<sup>6</sup> to account for the distance between the source and receiver and any screening or reflections provided by the surrounding buildings.

3.2.2 The 3D noise model has been calibrated to the noise levels attributed to Slack Road as presented in Section 3.2.

3.2.3 A noise contour plot illustrating the propagation of sound from source to receptor during the day ( $L_{Aeq,16hour}$ ), night time ( $L_{Aeq,8hour}$ ) and night time  $L_{Amax}$  condition is given in **Figure 7**, **Figure 8** and **Figure 9** respectively.

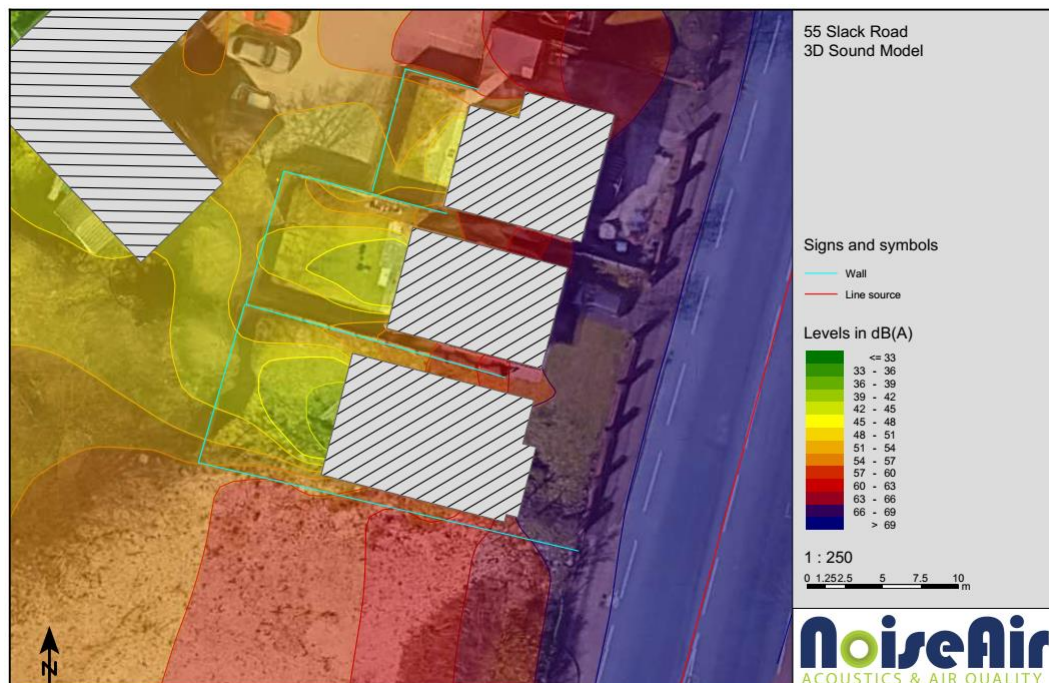


**Figure 7: Noise contour plot illustration of the predicted propagation of sound to the proposed development during the daytime –  $L_{Aeq,16hour}$ .**

<sup>6</sup> ISO9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"

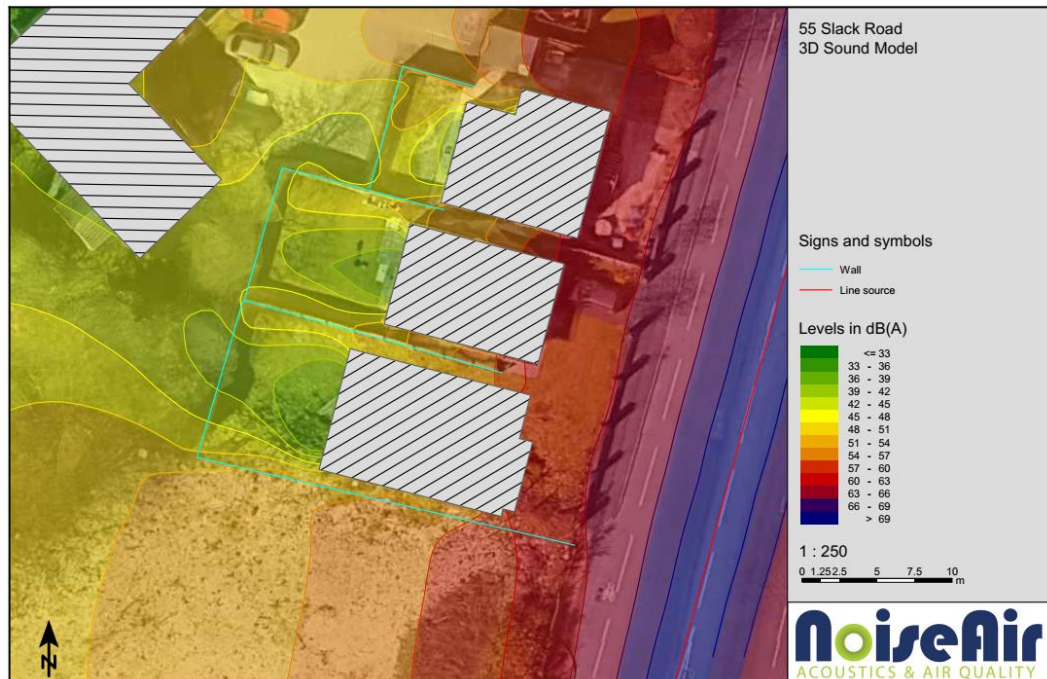


**Figure 8: Noise contour plot illustration of the predicted propagation of sound to the proposed development during the night-time –  $L_{Aeq,8hour}$ .**

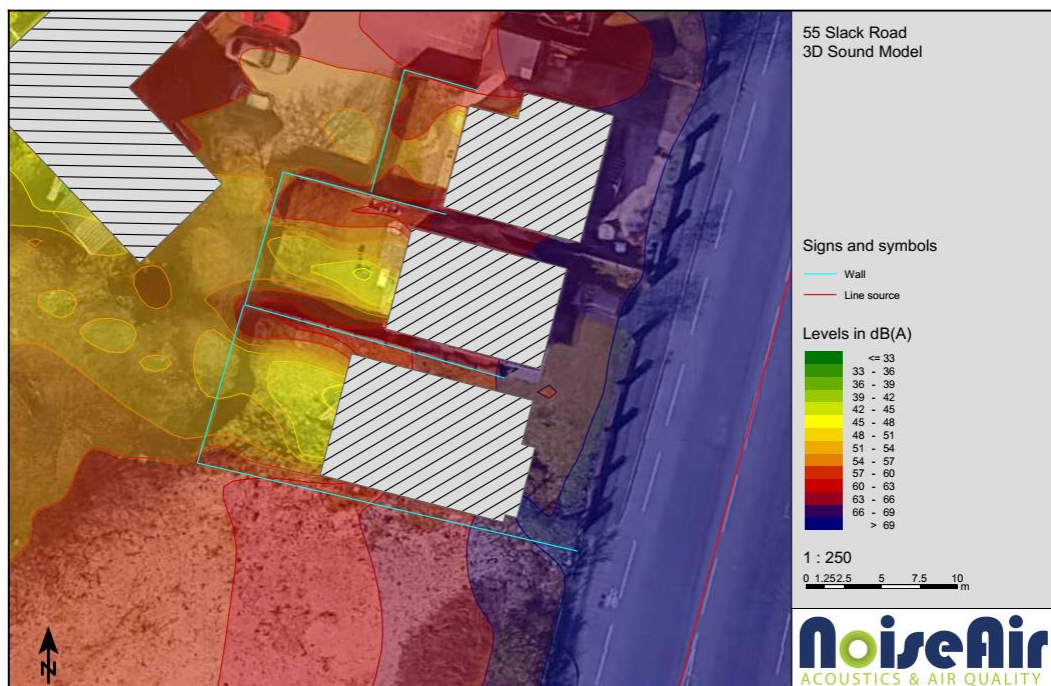


**Figure 9 Noise contour plot illustration of the predicted propagation of sound to the proposed development during the night-time –  $L_{max}$ .**

3.2.4 Predicted façade readings have also been calculated and are presented in **Figure 10**.



**Figure 10: Investigated receptor positions.**

3.2.5 The calculated noise levels for each façade are presented in **Table 6**.

| Table 6: Worst Case Predicted Façade Receptor Noise Levels |                                        |                                          |                              |
|------------------------------------------------------------|----------------------------------------|------------------------------------------|------------------------------|
| Façade Receptor                                            | dB L <sub>Aeq,16hours</sub><br>Daytime | dB L <sub>Aeq,8hours</sub><br>Night-Time | dB L <sub>Amax</sub> , Night |
| Front (1)                                                  | 64.4                                   | 59.6                                     | 66.3                         |
| Rear (3)                                                   | 42.5                                   | 37.7                                     | 41.4                         |

3.2.6 Garden/ amenity space noise levels have been calculated and are summarised in **Table 7**, full details of calculations to all receptors are presented in **Appendix B**.

| Table 7: Worst Case Predicted Garden/ Amenity Space Noise |                                        |
|-----------------------------------------------------------|----------------------------------------|
| Receptor                                                  | dB L <sub>Aeq,16hours</sub><br>Daytime |
| Gardens (4)                                               | 42.9                                   |

## 4 NOISE IMPACT ASSESSMENT

### 4.1 Assessment of Daytime Noise Levels in Outdoor Living Areas – WHO

- 4.1.1 At the time of writing, documentation provided shows an outdoor amenity area proposed at the development site, therefore, an assessment for this area has been conducted.
- 4.1.2 The proposed gardens space is calculated to be below the WHO guideline value of 50 dB(A) for people being moderately annoyed.

### 4.2 WHO and BS8233 Assessment of Daytime Noise Levels in Living Rooms and Bedrooms

- 4.2.1 The predicted noise levels at the façades of the proposed building structures, as detailed in **Table 6** and **Table 7** for the daytime and night-time period, together with the level of attenuation required in accordance with BS 8233: 2014 and WHO:1999, are presented in **Table 8**.

| Table 8: Level of Attenuation Required to Achieve the Internal Noise Guideline Levels. |                                                                                          |                                                                          |                                                  |                                                              |
|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------|
| Façade                                                                                 | Daytime<br>( $L_{Aeq,16hours}$ ) /<br>Night-Time<br>( $L_{Aeq,8hours}$ /<br>$L_{Amax}$ ) | Worst Case<br>Noise Level at<br>the Façade of<br>the Property<br>(dB(A)) | BS 8233:2014<br>Target Internal<br>Level (dB(A)) | Worst Case<br>Level of<br>Attenuation<br>Required<br>(dB(A)) |
| All                                                                                    | Daytime<br>$L_{Aeq,16hours}$                                                             | 64                                                                       | 35                                               | 29                                                           |
|                                                                                        | Night-Time<br>$L_{Aeq,8hours}$                                                           | 60                                                                       | 30                                               | 30                                                           |
|                                                                                        | Night-Time<br>$L_{Amax}$                                                                 | 66                                                                       | 45                                               | 21                                                           |

## 5 SOUND INSULATION SCHEME

### 5.1 Building Envelope Requirements – Windows Closed

- 5.1.1 Proposals for the development site at the time of writing outline residential use to all floors.
- 5.1.2 Noise sensitive rooms are proposed to all facades of the property. Therefore, internal noise levels are required to not exceed 35 dB  $L_{Aeq}$  during the daytime hours in all rooms and 30 dB  $L_{Aeq}$  and 45 dB  $L_{Amax}$  during the night-time hours in bedrooms.
- 5.1.3 When assessing sound levels in habitable areas of the proposed development, the sound attenuation provided by the overall building facade should be considered. To mitigate sound levels, the composition of the building facade can be designed to provide the level of attenuation required. Glazing is generally the building element which attenuates noise the least, so the proportion of glazing in a building facade is an important consideration when assessing overall sound attenuation. Additionally, any façade penetrations should also be considered such as for ventilation i.e., trickle ventilation.
- 5.1.4 Based on the design details forwarded, worst case façade attenuation calculations have been undertaken in accordance with BS EN ISO 12354-3:2017.
- 5.1.5 Calculations show that to achieve a reasonable internal acoustic environment in habitable rooms as specified within BS 8233:2014, the building envelope constructions should be selected to meet the sound reduction index (SRI) values presented in **Table 9**.

| Table 9: Building Envelope Requirements                                                                                                                                                                                                                                                                                                                                            |                      |                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------------------------------|
| Façade                                                                                                                                                                                                                                                                                                                                                                             | Room Type            | Estimated Building Façade Requirements <sup>1</sup>  |
|                                                                                                                                                                                                                                                                                                                                                                                    |                      | With Passive Vents                                   |
| Front & Rear                                                                                                                                                                                                                                                                                                                                                                       | Bedroom              | Window – 38 dB $R_w+C_{tr}$ <sup>2</sup>             |
|                                                                                                                                                                                                                                                                                                                                                                                    |                      | Passive Vent – 38 dB $D_{n,e,w}+C_{tr}$ <sup>3</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                    | Living / Dining Room | Window – 38 dB $R_w+C_{tr}$ <sup>2</sup>             |
|                                                                                                                                                                                                                                                                                                                                                                                    |                      | Passive Vent – 38 dB $D_{n,e,w}+C_{tr}$ <sup>3</sup> |
| <sup>1</sup> Wall construction assumed to be not less than 50 dB $R_w+C_{tr}$ , roof construction assumed to be not less than 47 dB $R_w+C_{tr}$ . Calculations have been conducted in accordance with BS EN ISO 12354-3:2017 methodology.<br><sup>2</sup> Window area assumed to be not more than 4.0 m <sup>2</sup> per room.<br><sup>3</sup> Up to 1 no. passive vent per room. |                      |                                                      |

- 5.1.6 **Table 10** below outlines typical examples for the building elements considered in **Table 9**. It should be noted that the typical examples presented in **Table 10** are for information only and specialist manufacturer design/ advice should be sought. Alternative options to those

outlined in **Table 10** can be considered however the performance criteria should be confirmed.

| Table 10: Summary Examples of Building Envelope Performance Elements. |                        |                                                                                                                                                                                                              |
|-----------------------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Walls                                                                 | $50 R_w + C_{tr}$      | Typical Example: Concrete / Brick exterior wall with min. 100 mm insulated (60 kg / m <sup>3</sup> rockwool) cavity constructed with timber studwork and resilient bars with min. 10 mm plasterboard lining. |
| Glazing                                                               | $38 R_w + C_{tr}$      | Typical Example: Double glazed laminated unit with pane of 10 mm – 16 mm air filled cavity – Pilkington Optiphon pane of 8.8 mm.                                                                             |
| Window Trickle Vent                                                   | $38 D_{ne,w} + C_{tr}$ | Typical Example – Titon Trickle Vent TA5225 (V75) + TA5005 (SF 418) 2500EA.                                                                                                                                  |

5.1.7 The glazing element typical examples outlined in **Table 10** are based on the performance of the glazing panes only, advice should be sought from the manufacturer at detailed design stage to ensure that the window framing does not undermine the overall performance requirement recommended in **Table 9**.

5.1.8 Building envelope performance elements outlined in **Table 9** and **Table 10** are based on the information provided at the time of writing and assumptions based on typical requirements for such projects. The building envelope final design should be confirmed through detailed design at the appropriate stage including the consultation of specialist manufacturers to confirm individual building element performance.

## 5.2 Acoustic Ventilation Requirements

5.2.1 It is recommended that the acoustic ventilation proposed at the site should, as a minimum, comply with Building Regulations 2022 Approved Document F1 Means of Ventilation and British Standard BS5925 1991: “Code of Practice for Ventilation Principles and Designing for Natural Ventilation”. Acoustic ventilation is only recommended for noise sensitive rooms, which are bedrooms and living/dining rooms.

5.2.2 Where a passive ventilation system is incorporated into the design, ventilators should be acoustically treated for habitable rooms to all facades. Ventilation openings to these rooms should match or exceed the minimum values set out in **Table 9** and **Table 10**.

5.2.3 The implementation of the recommended glazing together with appropriate acoustic ventilation would ensure that the required internal daytime and night-time noise limits are achieved.

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- 5.2.4 It should be further noted that the glazing and ventilation configurations within this report are for guidance only. Similar products to those used in NoiseAir calculations may achieve a similar level of sound reduction however this should be verified by the manufacturer.
- 5.2.5 As detailed in Section 6.2, it is likely that noise levels in noise sensitive rooms within some of the proposed dwellings will likely rely on the windows being in the closed position and therefore appropriate ventilation design should be completed. It is likely that a passive ventilation system can be adopted throughout the development site. Basic acoustic requirements for any passive ventilation which may be installed are outlined in Section 6.1 however it should be noted that ventilation requirements for future occupants of the proposed development are outside the scope of this report.

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## 6 CONCLUSIONS

- 6.1.1 NoiseAir has carried out a noise impact assessment with respect to a proposed residential development at 55 Slack Road, Manchester M9 8NJ.
- 6.1.2 1.4.1 Proposals for the development site outline the erection of two storey, detached dwellinghouse (Class C3) with associated parking, landscaping and boundary treatment.
- 6.1.3 It has been determined that the predominant source of noise which affects the development site is local traffic noise (from Slack Road). Noise breakout affecting the development site has been measured and used to construct a 3D sound model to investigate the likely noise impacts.
- 6.1.4 Sound insulation requirements are presented in TABLE of Section 5. It is anticipated that standard building construction can be adopted with the inclusion of the following glazing and passive/ trickle ventilators acoustic specification:
- Glazing – 38 dB  $R_w+C_{tr}$ ; and,
  - Trickle Ventilators – 38 dB  $D_{ne,w}+C_{tr}$ .

## **APPENDIX A - REPORT LIMITATIONS**

This Report is presented to Mr Nurul Haque and may not be used or relied on by any other person or by the client in relation to any other matters not covered specifically by the scope of this report.

Notwithstanding anything to the contrary contained in the report, NoiseAir Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Mr Nurul Haque and NoiseAir shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

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The conclusions and recommendations contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from who it has been requested and that such information is accurate. Information obtained by NoiseAir Limited has not been independently verified by NoiseAir Limited unless otherwise stated in the report and should be treated accordingly.

Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Where / if estimates and projects are made within this report, are made based on reasonable assumptions as of the date of this report, such statements however by their very nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. NoiseAir Limited specifically does not guarantee or warrant any estimates or projects contained in this report.

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## **APPENDIX B - GLOSSARY**

|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A-weighted sound pressure, <math>p_A</math></b>                                                 | Value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.<br><i>NOTE: The A-weighting network modifies the electrical response of a sound level meter with frequency in approximately the same way as the sensitivity of the human hearing system.</i>                                                                                                                                                                                      |
| <b>A-weighted sound pressure level, <math>L_{pA}</math></b>                                        | Quantity of A-weighted sound pressure in decibels (dBA).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Acoustic environment</b>                                                                        | Sound from all sound sources as modified by the environment [BS ISO 12913-1:2013].                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Ambient sound</b>                                                                               | Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.<br><i>NOTE: The ambient sound comprises the residual sound and the specific sound when present.</i>                                                                                                                                                                                                                                                                                                                     |
| <b>Ambient sound level, <math>L_a = L_{Aeq,T}</math> (BS4142:2014)</b>                             | Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T<br><i>NOTE: The ambient sound level is a measure of the residual sound and the specific sound when present.</i>                                                                                                                                                                                                     |
| <b>Background sound</b>                                                                            | Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Background sound level, <math>L_{A90,T}</math> (BS4142:2014)</b>                                | A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.                                                                                                                                                                                                                                                                                                                         |
| <b>Break-in</b>                                                                                    | Noise transmission into a structure from outside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Break-out</b>                                                                                   | Noise transmission from inside a structure to the outside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Cross-talk</b>                                                                                  | Noise transmission between one room and another room or space via a duct or other path.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b><math>C_{tr}</math></b>                                                                         | Correction term applied against the sound insulation single-number values ( $R_w$ , $D_w$ , and $D_{nT,w}$ ) to provide a weighting against low frequency performance.<br><i>NOTE: The reference values used within the <math>C_{tr}</math> calculation are based on urban traffic noise.</i>                                                                                                                                                                                                                                                      |
| <b>Equivalent continuous A-weighted sound pressure level, <math>L_{Aeq,T}</math></b>               | Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time.                                                                                                                                                                                                                                                                                                            |
| <b>Equivalent continuous A-weighted sound pressure level, <math>L_{Aeq,T}</math> (BS4142:2014)</b> | Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$ , has the same mean-squared sound pressure as a sound that varies with time.                                                                                                                                                                                                                                                                                                                           |
| <b>Equivalent sound absorption area of a room, A</b>                                               | Hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m <sup>2</sup> ), which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration                                                                                                                                                                                                                                                                                       |
| <b>Facade level</b>                                                                                | Sound pressure level 1 m in front of the façade.<br><i>NOTE: Facade level measurements of <math>L_{pA}</math> are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the facade.</i>                                                                                                                                                                                                                                                                                                          |
| <b>Free-field level</b>                                                                            | Sound pressure level away from reflecting surfaces.<br><i>NOTE: Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source). Estimates of noise from aircraft overhead usually include a correction of 2 dB to allow for reflections from the ground.</i> |

|                                                                         |                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Impact sound pressure level, <math>L_i</math></b>                    | Average sound pressure level in a specific frequency band in a room below a floor when it is excited by a standard tapping machine or equivalent.                                                                                                                                                                         |
| <b>Indoor ambient noise</b>                                             | Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants.<br><i>NOTE: The location(s) within the room at which the ambient indoor noise is to be measured or calculated ought to be considered.</i> |
| <b>Measurement time interval, <math>T_m</math> (BS4142:2014)</b>        | Total time over which measurements are taken.<br><i>NOTE: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.</i>                                                                                                                                                           |
| <b>Noise criteria</b>                                                   | Numerical indices used to define design goals in a given space.                                                                                                                                                                                                                                                           |
| <b>Noise rating, NR</b>                                                 | Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves.                                                                                                                                                                                                                 |
| <b>Normalised impact sound pressure level, <math>L_n</math></b>         | Impact sound pressure level normalized for a standard absorption area in the receiving room.<br><i>NOTE: Normalised impact sound pressure level is usually used to characterize the insulation of a floor in a laboratory against impact sound in a stated frequency band.</i>                                            |
| <b>Octave band</b>                                                      | Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.                                                                                                                                                                                                                       |
| <b>Percentile level, <math>L_{AN,T}</math></b>                          | A-weighted sound pressure level obtained using time-weighting "F", which is exceeded for $N\%$ of a specified time interval.                                                                                                                                                                                              |
| <b>Reference time interval, <math>T_r</math> (BS4142:2014)</b>          | Specified interval over which the specific sound level is determined.<br><i>NOTE: This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.</i>                                                                                                                 |
| <b>Residual sound (BS4142:2014)</b>                                     | Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.                                                                                                                                                        |
| <b>Residual sound level, <math>L_r = L_{Aeq,T}</math> (BS4142:2014)</b> | Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, $T$ .                                                                                                                                                                                  |
| <b>Rating level, <math>L_{A,r,T_r}</math></b>                           | Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.<br><i>NOTE: This is used in BS 7445 and BS 4142 for rating industrial noise, where the noise is the specific noise from the source under investigation.</i>                         |
| <b>Reverberation time, <math>T</math></b>                               | Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped.                                                                                                                                                                                                         |
| <b>Sound exposure level, <math>L_{AE}</math></b>                        | Level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.                                                                                                                                                                                                                   |
| <b>Sound level difference, <math>D</math></b>                           | Difference between the sound pressure level in the source room and the sound pressure level in the receiving room.                                                                                                                                                                                                        |
| <b>Sound pressure, <math>p</math></b>                                   | Root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound.                                                                                                                                                                              |
| <b>Sound pressure level, <math>L_p</math></b>                           | Quantity of sound pressure, in decibels (dB).                                                                                                                                                                                                                                                                             |
| <b>Sound reduction index, <math>R</math></b>                            | Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.                                                                                                                                                                                                       |

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Specific sound level,<br/><math>L_s = L_{Aeq,T_r}</math><br/>(BS4142:2014)</b> | Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, $T_r$ .                                                                                                                                                                                                   |
| <b>Specific sound source<br/>(BS4142:2014)</b>                                    | Sound source being assessed.                                                                                                                                                                                                                                                                                                                                           |
| <b>Standardised impact sound pressure level, <math>L'_{nT}</math></b>             | Impact sound pressure level normalized to a reverberation time in the receiving room of 0.5 s.                                                                                                                                                                                                                                                                         |
| <b>Standardised level difference, <math>D_{nT}</math></b>                         | Difference in sound level between a pair of rooms, in a stated frequency band, normalized to a reference reverberation time of 0.5 s for dwellings.                                                                                                                                                                                                                    |
| <b>Groundborne noise</b>                                                          | Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground.<br><i>NOTE Common sources of ground-borne noise include railways and heavy construction work on adjacent construction sites.</i>                                                                 |
| <b>Structure-borne noise</b>                                                      | Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.<br><i>NOTE Common sources of structure-borne noise include building services plant, manufacturing machinery and construction or demolition of the structure.</i>                                                         |
| <b>Third octave band</b>                                                          | Band of frequencies in which the upper limit of the band is 2% times the frequency of the lower limit.                                                                                                                                                                                                                                                                 |
| <b>Weighted level difference, <math>D_w</math></b>                                | Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions.<br><i>NOTE Weighted level difference is used to characterize the insulation between rooms in a building as they are. Values cannot normally be compared with measurements made under other conditions (see BS EN ISO 717-1).</i> |
| <b>Weighted normalised impact sound pressure level, <math>L'_{n,w}</math></b>     | Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.                                                                                                                                                                                                                                                         |
| <b>Weighted sound reduction index, <math>R_w</math></b>                           | Single-number quantity which characterizes the airborne sound insulating properties of a material or                                                                                                                                                                                                                                                                   |
| <b>Weighted standardised impact sound pressure level <math>L'_{nT,w}</math></b>   | Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.                                                                                                                                                                                                                                                         |
| <b>Weighted standardised level difference, <math>D_{nT,w}</math></b>              | Single-number quantity that characterizes the airborne sound insulation between rooms.                                                                                                                                                                                                                                                                                 |

## Symbols

|             |                                                            |
|-------------|------------------------------------------------------------|
| $D_w$       | Weighted level difference (dB)                             |
| $D_{nT}$    | Standardized level difference (dB)                         |
| $D_{nT,w}$  | Weighted standardized level difference (dB)                |
| $L_{Amax}$  | Maximum noise level (dB)                                   |
| $L_{Ar,Tt}$ | Rating level (dB)                                          |
| $L_n$       | Normalised impact sound pressure level (dB)                |
| $L'_{nT}$   | Standardised impact sound pressure level (dB)              |
| $L'_{nT,w}$ | Weighted standardised impact sound pressure level (dB)     |
| $L'_{n,w}$  | Weighted normalised impact sound pressure level (dB)       |
| $L_p$       | Sound pressure level (dB)                                  |
| $L_{pA}$    | A-weighted sound pressure level (dB)                       |
| $L_{AN,T}$  | Percentile level (dB)                                      |
| $L_{AE}$    | Sound exposure level (dB)                                  |
| $L_{Aeq,T}$ | Equivalent continuous A-weighted sound pressure level (dB) |
| $p$         | Sound pressure (Pa)                                        |
| $p_A$       | A-weighted sound pressure (dB)                             |
| $p_{A(t)}$  | Instantaneous A-weighted sound pressure (Pa)               |

|       |                                                      |
|-------|------------------------------------------------------|
| $R$   | Sound reduction index (dB)                           |
| $R_w$ | Weighted sound reduction index (dB)                  |
| $T$   | Time interval (also used for reverberation time) (s) |
| $t_0$ | Reference time interval (s)                          |

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[WWW.NOISEAIR.CO.UK](http://WWW.NOISEAIR.CO.UK)

