



MR M. A. HAMZA

25 WOODFOLD AVENUE, LEVENSHULME

NOISE ASSESSMENT FOR PLANNING PURPOSES

28 April 2022

AEC REPORT: P4571/R1a/RDC

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1.0 INTRODUCTION

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by Mr M. A. Hamza to undertake a noise and vibration assessment in relation to the proposed residential development at 25 Woodfold Avenue, Levenshulme.
- 1.2 This report details the noise and vibration levels measured on the development site, presents the assessment criteria and discusses the implications on the site layout and building design, to achieve acceptable noise and vibration level limits as required by the Local Authority.
- 1.3 It should be noted that the development has been granted permission with a pre-commencement condition formed of two parts in relation to acoustics and vibration. These are discussed further in Section 4.
- 1.4 Acoustic terminology is discussed in brief in Appendix A.

2.0 BACKGROUND AND SITE DESCRIPTION

- 2.1 The proposed development will be comprised of a single-storey extension to the existing house located at 25 Woodfold Avenue. A site location plan is presented on the attached Figure 1 and a proposed site layout is presented in Figure 2, at the back of this report.
- 2.2 The house is bound by Woodfold Avenue to the north, existing houses on Woodfold Avenue to the east, the rear of the properties that overlook Belvoir Avenue to the south, and the Levenshulme – Ardwick railway line to the west.
- 2.3 The railway line is raised on an embankment which is approximately level with the height of the first-floor rooms of 25 Woodfold Avenue. There is no existing boundary fence located across the railway tracks.
- 2.4 Based on the trainline timetable, it is understood that there are approximately 25 trains that pass by the site each hour between 0700 and 2300h, Monday to Friday.
- 2.5 The proposed extension will be two-fold; the existing garage will be replaced with a 'family room', a 'storage' area and a bathroom, and the existing dining room will be extended out the rear of the house into the garden. It is understood that the family room will be used as a second living room. There will be no new bedrooms within the extension.
- 2.6 The nearest elevation of the extension will be around 12m from the nearest railway track. There will be new glazing installed within the toilet, family room and dining room extension. The new dining room window will be the only aperture that directly overlooks the railway line.
- 2.7 As the extension will not include any bedrooms, an assessment of noise during the night-time period (2300 – 0700h) has not been carried out.

3.0 NOISE & VIBRATION MEASUREMENTS

- 3.1 AEC has undertaken noise and vibration measurements around the proposed development site and these are discussed separately, below.

Noise Level Measurements

- 3.2 An extended unattended noise level survey was undertaken between 1200h on Thursday 14 April 2022 and 0900h on Friday 15 April 2022, at a single location out of a first-floor window of the southern façade of 25 Woodfold Avenue. This location is identified as L on Figure 1. Full logged data over 15-minute periods are held on file by AEC and is available on request.
- 3.3 All measurements were undertaken in general accordance with BS7445-1: 2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*' and a full measurement procedure is presented in Appendix B.
- 3.4 This measurement location was chosen to measure noise levels from train pass bys as well as from any other noise sources in the area. Due to its Location, measurement Location L had a 90-degree angle of view to the railway line. A graph of the measured data is presented in Graph B1 of Appendix B.
- 3.5 A summary of the ambient noise levels measured during the two daytime periods (1200 – 2300h and 0700 – 0900h) is presented in Table 3.1, below.

Table 3.1 – Summary of Measured Free-field External Noise Levels

Daytime Period	Noise levels, dB L _{Aeq, T}
1200 – 2300h	61
0700 – 0900h	60

- 3.6 Throughout the measurement period, ambient noise levels were consistent and dominated by train pass bys. In the absence of any trains, noise levels were due to very distant road traffic and there was no other dominating noise source in the area.
- 3.7 AEC has compared the number of trains that passed by the site with the trainline timetable and can confirm that the noise levels measured are of typical train operations.

Vibration Measurements

- 3.8 Vibration levels were measured by AEC between approximately 1050 to 1125h on Thursday 14 April 2022. The transducers for the vibration monitoring system were installed at a location representative of the nearest part of the proposed property to the railway line (a worst-case), approximately 12m away from the nearest rail.
- 3.9 The measurements made were typical of the standard tram timetable with trams operating at typical service frequencies. The results are presented in Section 6.

4.0 BASIS OF ASSESSMENT

Noise

National Planning Policy Framework

- 4.1 The latest Planning Policies are included in the National Planning Policy Framework published by the Department for Communities and Local Government and dated March 2012 and revised in February 2019.
- 4.2 This planning policies which relate specifically to noise are presented in paragraphs 170, 180 and 182 which are reproduced below:

170. *Planning policies and decisions should contribute to and enhance the natural and local environment by:*

e preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of noise.

180. *Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

(5) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

(b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

182. *Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*

- 4.3 Further to the above, the Governments 'Planning Practice Guidance' published on 6 March 2014 and updated on 22 July 2019 states:

'Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). When preparing plans, or taking decisions about new development, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset.'

- 4.4 In addition, the guidance indicates that, whilst noise can override other planning concerns, it is important to look at noise in the context of the wider characteristics of a development proposal, its likely users and its surroundings, as these can have an important effect as to whether or not noise is likely to pose a concern.

Local Authority Requirements

- 4.5 Manchester City Council has produced '*Planning & Noise – Technical Guidance*' (2015) (PNTG) in relation to their requirements for noise and vibration assessments to accompany planning applications.
- 4.6 Based on this guidance, the development has been granted permission with a single noise and vibration pre-condition and this is as follows (Application number: 129882/FO/2021):

"5.Acoustic Insulation

a) Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from the mainline railway 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:

<i>Bedrooms (night time - 23.00 - 07.00)</i>	<i>30 dB L_{Aeq} (individual noise events shall not exceed 45 dB L_{Amax,F} by more than 15 times)</i>
<i>Living Rooms (daytime - 07.00 - 23.00)</i>	<i>35 dB L_{Aeq}</i>
<i>Gardens and terraces (daytime)</i>	<i>55 dB L_{Aeq}</i>

b) Due to the proximity of the development to the mainline railway vibration criteria shall also apply as per BS 6472: 2008 "Guide to evaluation of human exposure to vibration in buildings". Ground borne noise shall also be factored into the assessment and design."

- 4.7 In addition to the PNTG, these noise level limits are also based on guidance presented in BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS8233) and the Association of Noise Consultants (ANC) document '*ProPG: Planning and Noise - New Residential Development*', 2017 (ProPG).
- 4.8 It should be noted that Paragraph A.11 of ProPG does state that "*It is generally accepted, however, that the smaller the number of the noise events, the higher the maximum levels that can be withstood without adverse effects on sleep (up to an upper limit, and providing the overarching noise level during the overall sleep period e.g. L_{Aeq,T} does not exceed a suitable threshold)*".
- 4.9 In addition to the above, ProPG assumes that the attenuation of free-field external noise levels to internal noise levels provided by a window partially open for ventilation is up to 15dB. Therefore, to ensure that whole dwelling (background) ventilation can be provided via a partially open window at the nearby properties, AEC would propose that the external

noise levels outside habitable rooms should not exceed $50\text{dBL}_{\text{Aeq,T}}$ during the daytime, and $45\text{dBL}_{\text{Aeq,T}}$ and $65\text{dBL}_{\text{Amax,F}}$ at night.

Ventilation and Control of Overheating

- 4.10 The ventilation specifications presented in BS8233 and ProPG are based on achieving the requirements of Approved Document F (ADF) 'Ventilation' (2010) of the Building Regulations only.
- 4.11 ADF requires that continuous whole dwelling (background) ventilation be provided to limit the accumulation of moisture and other pollutants originating within a building. This is typically achieved either via a partially opened window, or by a whole building ventilation system through the provision of trickle ventilators or mechanical ventilators. ADF states that *'The ventilation provisions will not necessarily meet cooling needs'*.
- 4.12 ProPG notes that the attenuation of external to internal noise levels provided by a window partially open for whole dwelling ventilation is no more than 15dB.
- 4.13 Therefore, for daytime habitable rooms to have whole dwelling ventilation via a partially open window, external noise levels outside habitable rooms should not exceed $50\text{dBL}_{\text{Aeq,16h}}$ during the daytime.
- 4.14 In relation to purge ventilation, ProPG suggests that as this should only occur occasionally (e.g., to remove odour from painting and decorating or from burnt food), the internal desired noise levels are not generally applicable. Therefore, internal noise levels due to windows being opened for purge ventilation has not been discussed further.
- 4.15 To provide guidance on the relationship between internal noise levels and the control of overheating in residential properties, the ANC issued *'Acoustic ventilation and Overheating – Residential Design Guide'* (AVO) in January 2020. It is important to note that this is a design guide only and not a statutory document and the Local Authority may have their own requirements.
- 4.16 At this stage AEC are unaware of any specific Local Authority requirements in relation to acceptable internal noise level limits in habitable rooms with windows open to aid with the control of overheating. Therefore, this indicative assessment is based on the guidance presented in AVO.
- 4.17 Table 3.3 of AVO presents guidance for allowable noise from transportation sources whilst windows are open for the control of overheating. With reference to this document AEC would propose that windows can be utilised in the control of overheating provided that the resultant internal ambient noise levels are below approximately $50\text{dBL}_{\text{Aeq, 16h}}$ during the daytime.
- 4.18 These internal noise levels are the upper end of the medium risk category for adverse effects. Where these internal noise levels would be exceeded, AVO states that *"noise causes a material change in behaviour (e.g., having to keep windows closed most of the time)"*. In this situation, AEC would suggest alternative means for the control of overheating are considered, which do not rely on open windows.

- 4.19 AVO states that where transportation is the main source of noise, *“it is assumed that a partially open window will provide an outside-to-inside level difference of 13dB and is considered representative of typical domestic rooms with simple façade openings of around 2% of the floor area”*. Based on AEC’s experience, this is also applicable to sources such as aircraft movements.
- 4.20 Considering the above, it is considered acceptable to control summertime heating via opening windows where external free-field noise levels are no greater than those presented in the following Table 4.1. This is based on simple façade openings to around 2% of the floor area.

Table 4.1 – External Free-Field Noise Level Limits for the Control of Overheating via Openable Windows

Activity	Location	Noise Level Limit, dB		
		Daytime 0700 – 2300h	Night-Time 2300 – 0700h	
		L _{Aeq,16h}	L _{Aeq,8h}	L _{Amax,F}
Resting	Living Room	63	-	-
Dining	Dining Room/Area	63	-	-

- 4.21 The limits presented in Table 4.1 are subject to agreement with the Local Authority and may be subject to change.

External Noise Level Limits

- 4.22 As there are no garden areas that are being installed as part of the works, a noise level criterion for any external amenity areas has not been discussed nor assessed.

Vibration

- 4.23 The assessment of vibration on humans within buildings is presented in BS 6472-1:2008 ‘Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting’ (BS6472). The assessment of vibration on buildings i.e. damage, is presented in BS 7385-2:1993 ‘Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration’ (BS7385-2).
- 4.24 BS6472 uses acceleration in terms of a ‘vibration dose value’ (VDV), which is a measure of vibration exposure, weighted for human perception, over a specified time period, to determine human response to vibration within a building.
- 4.25 The VDV at which various degrees of adverse comment may be expected in residential buildings are reproduced in Table 4.2, below. Please note as the extension only relates to ‘daytime’ rooms, no criteria for the night-time period has been set nor discussed further.

Table 4.2 – Vibration Dose Values Relating to Various Degrees of Adverse Comment

Place and Time	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6

Vibration dose values ($\text{m/s}^{1.75}$) above which various degrees of adverse comment may be expected

- 4.26 The levels at which vibration resulting from railway movements could cause damage to a residential property are presented in BS7385-2. This guidance uses the Peak Particle Velocity (PPV) of an event to determine whether vibration could potentially cause cosmetic damage to a property.
- 4.27 Based on BS7385-2, the risk of cosmetic damage is considered minimal below 15mm/s PPV, unless the building condition, foundations and/or ground type make it more susceptible to vibration. In addition, it is understood that certain soils can start to become vulnerable at levels of 10mm/s to the potential for differential settlement of ground caused by vibrations.
- 4.28 Therefore, taking the above into account, it is considered that PPV levels below 10mm/s should be deemed acceptable in relation avoiding the potential for causing cosmetic damage to a new development.

Groundborne / Re-radiated Noise

- 4.29 Ground-borne vibration energy will enter the building structure and be re-radiated from walls, floors and ceilings as noise within the building. The re-radiated noise level is dependent on the sound absorption in the room, the size and shape of the room and the distribution of vibrational energy across the surfaces of the room.
- 4.30 There is no standard or criteria defining acceptable ground-borne noise levels. A commonly adopted ground-borne noise level limit inside bedrooms, due to train movements, is **35 to 40dB_LA_{max,s}**. Although this may not necessarily be inaudible, this maximum level would minimize the risk of annoyance and disturbance to sleep. As previously stated, the proposed development does not include for any bedrooms, however, this limit will be used to assess daytime rooms within the extension.

5.0 ASSESSMENT OF PROPOSED DEVELOPMENT

- 5.1 As highlighted in AEC's noise level survey, the dominating noise source affecting the proposed extension is the activities associated with the railway line.
- 5.2 Based on the measured noise levels, the external free-field daytime ambient noise levels have been determined at a location representative of the new extension. This has based off distance and screening attenuation, where applicable and is presented in Table 5.1, below. It should be noted that a single worst-case noise level has been chosen for the entirety of the extension.
- 5.3 As previously stated, the noise levels measured at Location L were undertaken with 90-degree line of sight to the railway line and, therefore, a +3dB correction has been applied to the measured noise levels to account for full angle of view.
- 5.4 Whilst the noise levels were measured at first floor level (and the extension will not have any first-floor windows), using these to assess the ground floor extension will ensure that a robust assessment has been carried out.

Table 5.1 – Determined Daytime Noise Levels

Elevation	Ambient Noise Levels, $dBL_{Aeq,16h}$
All	≤ 63

Glazing and Ventilation Requirements

- 5.5 As stated in Section 3.0, for the habitable rooms within the extension to have whole dwelling ventilation provided via a window partially open, external noise levels should not exceed $50dBL_{Aeq,T}$ during the daytime.
- 5.6 A comparison between these levels and the determined noise levels presented in Table 5.1, indicates that alternative means of whole dwelling (background) ventilation would need to be provided to all habitable rooms on all elevations of the development.
- 5.7 The minimum sound insulation performances of the glazing and ventilators to meet the required internal noise level limits have been calculated based on the measured noise spectra and the glazing sizes of the windows presented on the architects' drawings. Please note that if these values are higher once architect drawings have been confirmed, then the glazing and ventilation specification presented below may need to be increased.
- 5.8 The minimum sound insulation performances are presented in Table 5.2, below. Example glazing build-ups to achieve the stated performances are also presented.

Table 5.2 – Outline Requirements of Glazing and Ventilation to Achieve Internal Noise Levels in Habitable Rooms

Sound Insulation Performance		
Glazing	Example Construction	Ventilator
40dBR _w / 34dBR _w + C _{tr}	6mm Glass / 16mm Argon / 6.8mm Optiphon	38dBD _{n,e,w}

- 5.9 Should an alternate glazing construction be chosen other than the example provided in Table 5.2, then the octave band performance requirements for alternate glazing products are presented in Table 5.3, below.

Table 5.3 – Minimum Glazing Sound Insulation Performance

Overall Glazing Sound Insulation Performance	Minimum Sound Insulation Performance, dB @ Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
40dBR _w / 34dBR _w + C _{tr}	16	21	28	37	48	48	54	59

- 5.10 All background ventilation sound insulation requirements have been based on the use of a single ventilator per room. If more than one unit is required, such as may be required to satisfy Building Control requirements, the performance of each unit might need to be increased.

Control of Overheating

- 5.11 If it is determined by others that there is a need to control overheating within this development, based on the noise level limits presented in Table 4.1, and the determined external noise levels presented in Table 5.1, all rooms can have windows open to provide comfort cooling for the control of overheating.

External Envelope

- 5.12 To maintain the sound insulation performance of the external envelope, the remainder of the façade construction should have a sound insulation performance of at least 10dB higher than the glazing.
- 5.13 This would be achieved with two 100mm concrete block (min. density of 1900kg/m³) layers separated by a 50mm cavity and alternate options can be discussed during the design stages.
- 5.14 In relation to the roof, the above glazing and ventilation requirements have been based on a roof with a minimum sound insulation performance of 46dBR_w. This is a standard construction comprised of a tiled roof with a void filled with mineral wool insulation and a plasterboard ceiling.

6.0 VIBRATION ASSESSMENT

- 6.1 Using the guidance in BS6472, the measured VDV values, and the expected number of trains on the line, the full 16-hour day VDV values have been calculated. Table 6.1, below, compares the highest calculated 16-hour daytime VDV values against the guidance provided in BS6472:2008.

Table 6.1 – Calculated 16-Hour Daytime VDV Levels Compared to BS 6472 Guidance

VDV period	Worst Case VDV _z , m/s ^{1.75}	BS 6472 “ <i>Low probability of adverse comment</i> ”
Day (0700 – 2300)	0.12	0.2 to 0.4

z – vertical

- 6.2 Table 6.1 demonstrates that the highest measured 16-hour and 8-hour VDV levels are at or below the levels where there is a low probability of adverse comment.
- 6.3 Based on our measurements, the PPV measured was approximately 0.3mm/s. As this is significantly below the proposed limit of 10mm/s, this would be acceptable and poses no issue regarding even cosmetic building damage.
- 6.4 N.B. Please notify AEC if the building foundation design requires piling or deep foundations into harder substrate / rock layers. This may introduce a different vibration transmission path and check measurements may be advised.

Groundborne / Re-radiated Noise

- 6.5 Based on the measured PPVs discussed above, and a typical crest factor of 4 for a rail pass-bys, and a conservative estimation of ground-borne noise levels inside the dwelling, re-radiated noise should not exceed 40dB_{L_{Amax,s}}. This estimate is based on the calculation methodology provided in Federal Transport of America-FTA Guidelines and vibration transfer functions provided in the Transportation Noise Reference Book, 1987.
- 6.6 Based on this estimate, the suggested limit of 35-40dB_{L_{Amax,s}} should not be exceeded.

7.0 SUMMARY AND CONCLUSIONS

- 7.1 Acoustic & Engineering Consultants Limited has been appointed by Mr M.A. Hamza to undertake a noise and vibration assessment of the proposed extension of 25 Woodfold Avenue, Levenshulme.
- 7.2 An extended unattended noise level survey was also undertaken between 1200h on 14 April 2022 and 0900h on 15 April 2022, at a single location out of a first-floor window of the southern façade of 25 Woodfold Avenue. This location is identified as L on Figure 1. Full logged data over 15-minute periods is held on file by AEC and is available on request.
- 7.3 During the measurement periods, railway noise was the dominant noise source affecting the elevations of the proposed extension.
- 7.4 Whilst on-site, a vibration survey was also undertaken. Further details of this survey, alongside the noise surveys presented above are discussed further in Section 3.
- 7.5 A basis of assessment for the development is presented in Section 4 for the noise and vibration sources.
- 7.6 Based on the noise level measurements, an assessment was carried out to determine the noise levels impacting each façade of the residential properties within the development.
- 7.7 These measured noise levels were determined in accordance with the Planning and Noise Technical Guidance. The resultant noise levels external to the different elevations consider screening, distance attenuation, where applicable, and the results are presented in Table 5.1 of Section 5.
- 7.8 Based on the calculated external noise levels presented in Table 5.1, it was determined that alternative means of ventilation (to opening windows) would need to be provided to all habitable rooms.
- 7.9 Based on this, mitigation measures for the development are proposed in Section 6. These mitigation measures are presented in the form of enhanced glazing and acoustic trickle vents.
- 7.10 In relation to the vibration levels measured on-site, an assessment was carried out in accordance with BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*'. This is presented in Section 7.
- 7.11 This demonstrated that the highest measured 16-hour VDV levels are at or below the levels where there is a low probability of adverse comment.
- 7.12 Based on ensuring that the mitigation measures presented in this assessment are implemented, internal noise levels would be controlled to suitable levels.

FIGURE 1 – Site Location Plan Identifying Monitoring Locations

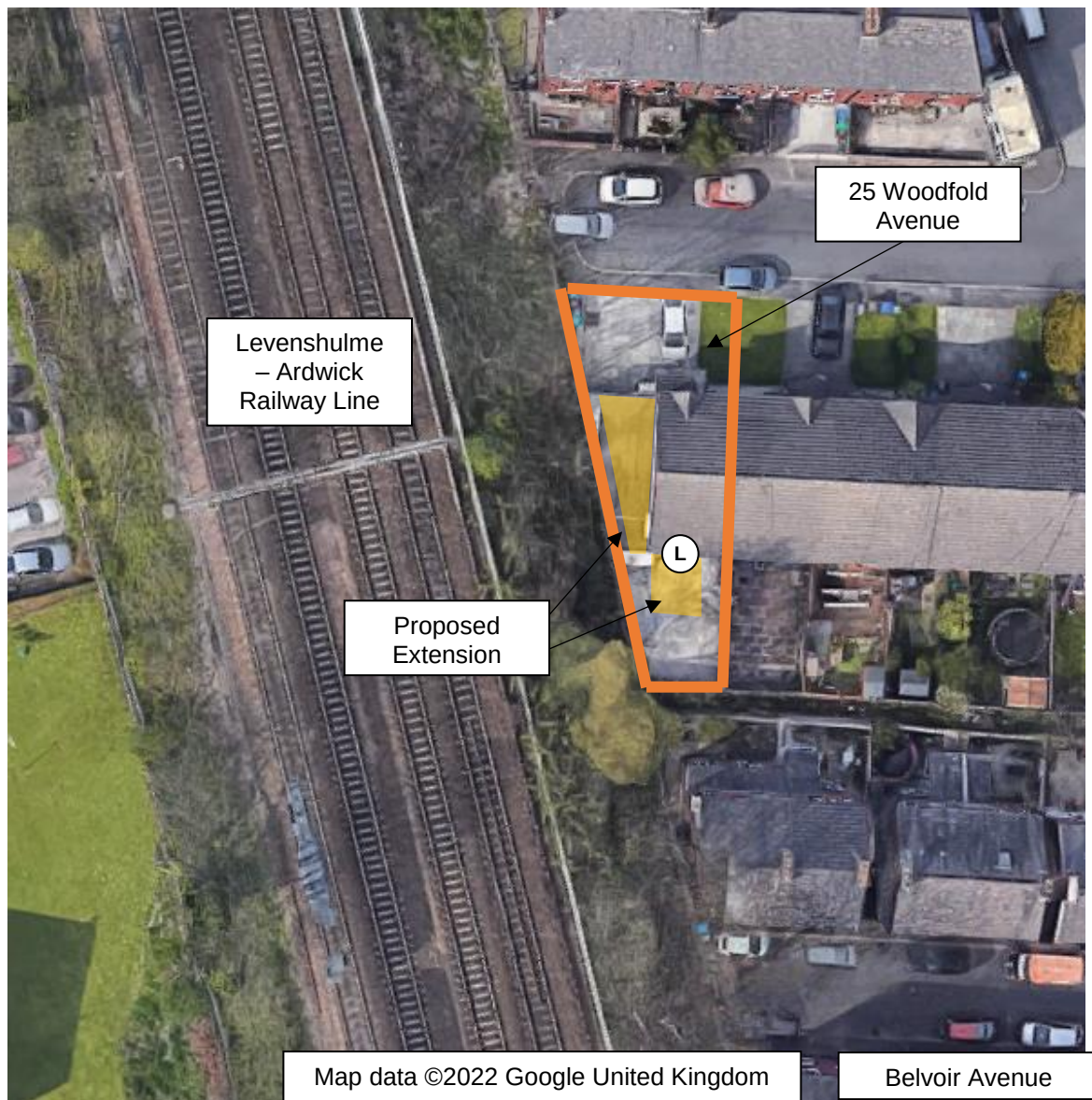
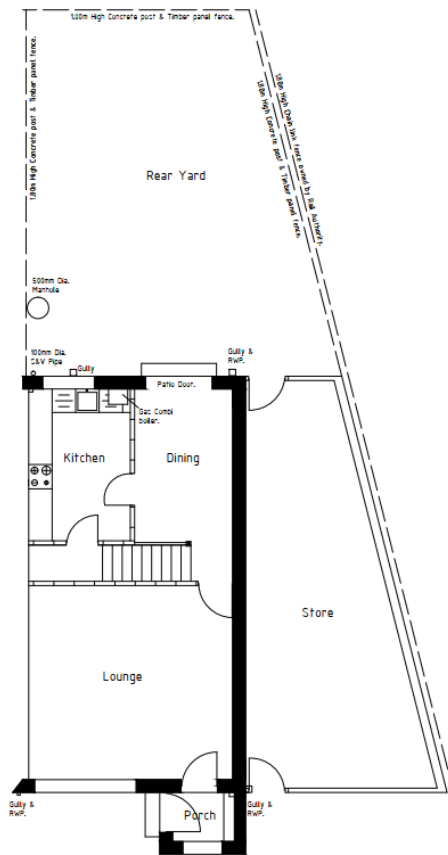
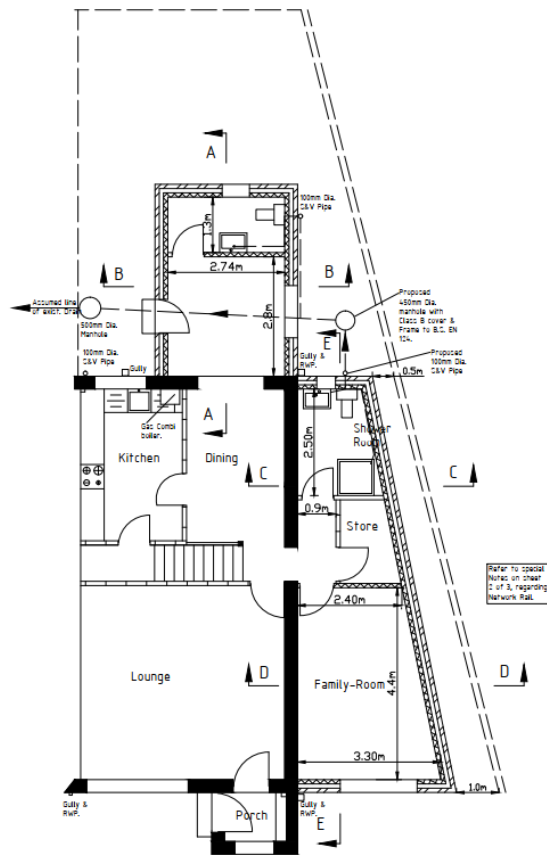


FIGURE 2 – Proposed Site Layout



Exist. Ground Floor Plan



Proposed Ground Floor Plan

APPENDIX A – Acoustic Terminology in Brief

Sound Description

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most sound is made up of many different frequencies.

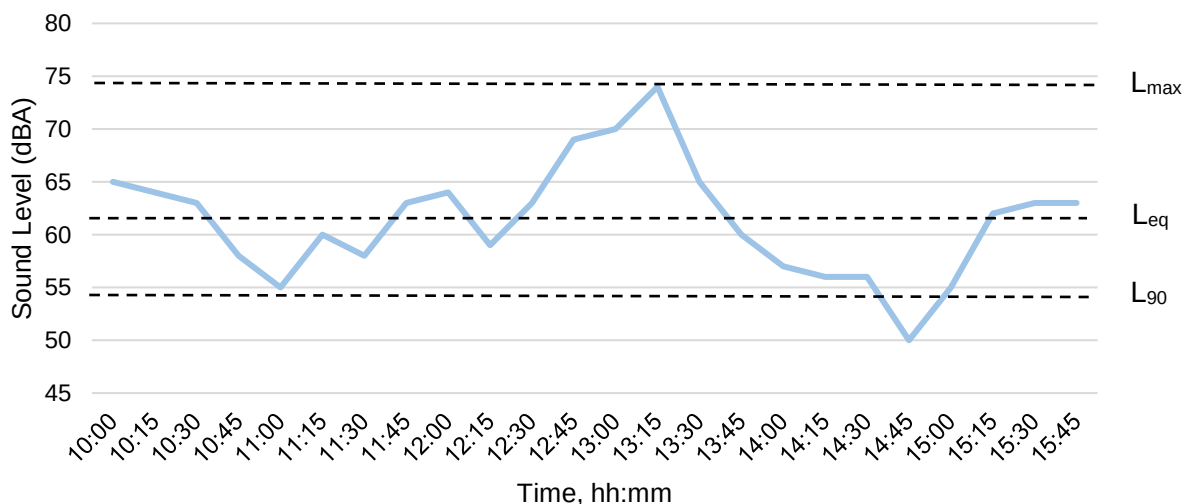
The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The *dBA* weighting emphasises or reduces the importance of certain frequencies within the audible range.

Sound Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the sound.

The figure below shows an example of sound level varying with time. Because of this time variation, the same period of sound can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be preceded by a dB descriptor in the report e.g. $L_{Aeq,T}$ could be written $dBL_{Aeq,T}$.

Example of Sound Varying with Time



Unit Type	Acoustic Unit	Description
Ambient Sound Level	$L_{Aeq, T}$	The equivalent continuous (A-weighted) sound level. It may be thought of as the “average” sound level over a given time, T. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the “ambient” noise level.
Percentile Level	L_{A10}	The (A-weighted) sound level exceeded for 10% of a measurement period. It is the value often used to describe traffic noise.
	L_{A90}	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise.
Maximum Sound level	L_{Amax}	The maximum (A-weighted) sound level measured during a given time. ‘Fast’ or ‘Slow’ meter response should be cited.
Sound Exposure Level (SEL)	L_{AE}	The sound exposure level is a notional noise level and describes the average L_{Aeq} noise level of an event over a given time period as if it occurred during a one second period. This allows the L_{Aeq} to be determined over a time period with a number of distinct events.
Free-field Level	-	This refers to the sound level measured outside, away from reflecting surfaces.
Façade Level	-	This refers to the sound level measured outside, at 1m from a hard-reflecting surface, typically 3dB greater than the free-field level.
Apparent sound reduction index	R'_w	Single number rating used to describe the sound reduction index of an on-site construction over a range of frequencies, typically 100-3150Hz.
Element normalized level difference	$D_{n,e,w}$	Single number rating used to describe the sound insulation performance of small elements.
Vibration Dose Value	-	Vibration Dose Value is a single number value and provides a convenient measure of the cumulative vibration received by a person during a measurement period. The measurement units are $m/s^{1.75}$.
Peak Particle Velocity	-	Peak particle velocity is the maximum velocity value of a vibration event during a measurement period. The measurement units are mm/s.

APPENDIX B – Noise Survey Details

Date & Time of Survey:	Thursday 14 April 2022, 1200h to Friday 15 April 2022, 0900h.					
Personnel:	Ross Chamberlain (AEC).					
Equipment Used:	Cirrus CR:171B Real Time Analyser (AEC Kit 3).					
Calibration:	The sound level analysers, which conforms to BS EN 61672-1: 2013 ' <i>Electroacoustics – Sound level meters - Part 1 Specifications</i> ' for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.					
Weather Conditions:	Date	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	14/04/22	Day	Dry	16°C	Negligible	20%
	14/04/22 – 15/04/22	Night	Dry	8°C	Negligible	40%
	15/04/22	Day	Dry	12°C	Negligible	26%
Measurement Locations:	The microphone was connected via an extension cable and fixed at a location 1m out of an upper floor window of 25 Woodfold Avenue, Levenshulme, identified as L on Figure 1.					
Measurement Details:	Measurements were logged continuously over 1s for post processing and assessment.					
Façade / Free-Field:	Façade level					
Measured Data:	Full octave band centre frequency data was obtained for all measurements.					

GRAPH B1 – Measured Night-Time Noise Levels
1500h on Tuesday 29 June 2021 to 0700h on Wednesday 30 June 2021,

