



RG Group

'The Fairfax', Portugal Street East, Manchester

Noise Impact Assessment

DC3706-R1



Report Version Issue Log

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Limitations to this Report

This report entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise affecting the site. The objectives of the investigation have been limited to establishing sources of noise material to carrying out an appropriate assessment.

The number and duration of noise measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise emitters. Furthermore, noise sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.

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1.0 INTRODUCTION

1.1 Details of Instruction

RG Group has appointed Dragonfly Consulting to carry out a Noise Impact Assessment in support of a condition discharge relating to their site at Portugal Street East, Manchester.

The noise assessment has been conducted with reference to the National Planning Policy Framework, appropriate British Standards and recognised guidance.

This report therefore describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria. Recommendations are also made with respect to the design of the development.

Measurement of external noise levels have been completed for the proposed development to allow demonstration by calculation that suitable internal noise levels will be achieved within the most noise exposed rooms.

A glossary of technical terminology is included in Appendix A to support this document.

1.2 Site Conditions

1.2.1 Existing Site Conditions

The site currently occupied by a now discussed and semi-derelict factory and office building. The development site is bounded by the following:

- Metrolink line to the north, with residential apartments immediately opposite the site;
- Oakgate Street to the east, with low level commercial buildings;
- Commercial buildings and Adair Street, a busy traffic street, to the south;
- Royal Mail HGV depot and car park to the west with Manchester Piccadilly Station beyond.

It is worthy of note that demolition and construction works are ongoing along Adair Street to the east of the site; however, these were not considered to be dominant in affecting the current noise environment.

1.2.2 Proposed Site Conditions

It is proposed to demolish the existing factory building and erect 2 no. buildings for C3 use with ancillary ground floor commercial use. The proposed ‘Block B1’ and ‘Block B2’ consist of a 29-storey tower building with a 23-storey tower building respectively.

2.0 GUIDANCE

2.1 Planning Permission 2020/03701/PA

Condition 18 of the extant permission states:

“Before the development commences a scheme for acoustically insulating and mechanically ventilating the residential accommodation against noise from adjacent roads and the adjacent tram and mitigating vibration and reradiated noise levels associated with the operation of the adjacent tram line shall be submitted to and approved in writing by the City Council as local planning authority.

The approved noise insulation scheme and vibration and reradiated noise mitigation measures shall be completed before any of the dwelling units are occupied. Prior to occupation a post completion report to verify that all of the recommended mitigation measures have been installed and effectively mitigate any potential adverse noise impacts in the residential accommodation shall be submitted and agreed in writing by the City Council as local planning authority. Prior to occupation any non-compliance shall be suitably mitigated in accordance with an agreed scheme.”

2.2 British Standards and Guidance Documents

2.2.1 British Standard (BS) 7445-1: 2003

The assessment of noise impact for this development has been undertaken by measuring external noise levels in accordance with the guidance detailed in BS 7445-1:2003 *Description and Measurement of Environmental Noise – Part 1: Guide to Quantities and Procedures*.

This document defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

The methods and procedures described in this British Standard are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site. This British Standard does not specify limits for environmental noise.

2.2.2 BS 8233: 2014

The scope of BS 8233:2014 *Sound insulation and noise reduction for buildings* is the provision of guidance for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations; the primary intention of these is to guide the design of new buildings or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate. The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 2.1.

Table 2.1
Indoor Ambient Noise Levels in Spaces When They Are Unoccupied

Activity	Typical Situations	Design Range $L_{Aeq, T}$ dB	
		0700h to 2300h	2300h to 0700h
Resting	Living rooms	35	--
Dining	Dining Room / Area	40	--
Sleeping	Bedrooms	35	30

BS 8233 states in Note 4 that:

“Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{A\text{Max},f}$ depending on the character and number of events per night. Sporadic noise events could require separate values.”

As such, it has been considered appropriate to define a limit for regular maximum noise levels of 45dB(A) with sporadic events not exceeding 55dB(A).

2.3 BS 6472-1:2008

BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting* details a measurement methodology and assessment criteria to determine the likely human response to vibration in buildings between 0.5Hz to 80Hz.

The procedure laid out in this standard involves determining the Vibration Dose Value (VDV) of an event thought to cause detectable vibration at the receptor, which is used to estimate the probability of adverse comment which might be expected from human beings experiencing vibration in buildings.

Table 1 of the document provides ranges of Vibration Dose Values, above which may result in adverse comment within residential buildings in increasing order. This is replicated in Table 2.2 below:

Table 2.2
Vibration dose value ranges which might result in various probabilities
of adverse comment within residential buildings

Place and time	Low probability of adverse comment $\text{m/s}^{-1.75}$ (1)	Adverse comment possible $\text{m/s}^{-1.75}$	Adverse comment probable $\text{m/s}^{-1.75}$ (2)
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

1) Below these ranges adverse comment is not expected.

2) Above these ranges adverse comment is very likely.

3.0 ASSESSMENT CRITERIA

3.1 Potential Sources of Environmental Noise

The following sources of noise are considered in the context this site:

Table 3.1
Assessed Sources of Environmental Noise

Assessment Type	Relevant Assessment Methodology
Amenity on Potential Occupants	BS 8233:2014

3.2 Selection of Noise Criteria

With reference to the guidance detailed in Section 2, the following criteria have been selected to determine the threshold of effect levels in the context of the extant planning condition.

Table 3.2
Assessment Criteria: BS 8233:2014

Effect Level	Criteria	Justification
Lowest Observed Adverse Effect Level (LOAEL)	Internal noise levels achieve the requirements of the BS 8233:2014 standard assuming windows are closed and an additional source of ventilation is provided	Noise levels within the BS 8233:2014 criteria whilst ensuring no conflict with acceptable levels of indoor air quality management are considered to be suitable
Significant Observed Adverse Effect Level (SOAEL)	Internal noise levels fail to achieve the BS 8233:2014 standard by more than 5dB assuming windows are closed and an additional source of ventilation is provided	None Mitigate to achieve LOAEL Criteria

With reference to the guidance within BS 8233:2014, the predicted internal levels have been assessed against the following criteria:

- $L_{Aeq,16h}$ (Daytime) – internal levels must not exceed 35dB $L_{Aeq,16h}$;
- $L_{Aeq,8h}$ (Night-time) – internal levels must not exceed 30dB $L_{Aeq,8h}$;
- L_{AFMax} (Typical) – internal levels must not exceed 45dB L_{AFMax} on more than 10 occasions per night.

3.3 Potential Sources of Ground Borne Vibration

The following sources of vibration are considered in the context this site:

Table 3.3
Assessed Sources of Environmental Noise

Assessment Type	Relevant Assessment Methodology
Amenity on Potential Occupants	BS 6472:2008

3.4 Selection of Vibration Criteria

With reference to the guidance detailed in Section 2, the following criteria have been selected to determine the threshold of effect levels in the context of the extant planning condition.

Table 3.4
Assessment Criteria: BS 6472:2008

Effect Level	Criteria	Justification
Lowest Observed Adverse Effect Level (LOAEL)	0.4 m/s ^{-1.75} Daytime 0.2 m/s ^{-1.75} Night-time	Vibration levels below the levels identified in the BS 6472:2008 standard for adverse comment possible
Significant Observed Adverse Effect Level (SOAEL)	0.8 m/s ^{-1.75} Daytime 0.4 m/s ^{-1.75} Night-time	Vibration levels meet the levels identified in the BS 6472:2008 standard for adverse comment probable

4.0 ENVIRONMENTAL NOISE SURVEY

Two noise surveys have been undertaken to support this assessment:

- A baseline noise survey was undertaken from the 3rd to the 7th of March 2022 to establish the existing noise environment at the relevant site boundaries.
- Ground borne vibration measurements were undertaken from the 9th to the 10th of March 2022 to monitor ground borne vibration at the foundation of the existing building from passing trams.

4.1 Survey Methodology

The equipment used during the survey is detailed in Appendix B. The sound level meters were calibrated before and after the measurements and no significant calibration drifts were found to have occurred (>0.2dB). All of the noise monitoring equipment had been calibrated to a traceable standard within the twenty-four months preceding the survey. Calibration certificates are available on request.

Three measurement locations were surveyed in order to establish the typical ambient and background noise levels at the proposed development site. The measurement locations are hereby referred to in this report as follows:

- ‘Location 1’ – sound level meter positioned out of a former window at second floor level on the northwestern corner of the existing building, 1m from the western façade;
- ‘Location 2’ – sound level meter positioned out of a former window at second floor level on the southwestern corner of the existing building, 1m from the western façade;
- ‘Location 3’ – Vibration meter positioned on the ground, adjacent to the northern façade of the existing building.

The measurement locations are shown in Appendix C.

4.2 Survey Results

The weather during the unattended survey was recorded and all periods surveyed were suitable for the noise measurements, being dry with low wind speeds.

Summaries of the measured noise and vibration levels are given in Tables 4.1 and 4.2 overleaf. Full survey results are available upon request. Note that the measured noise levels at ‘Location 1’ and ‘Location 2’ have been corrected from façade conditions to free field by the subtraction of 3dB.

Table 4.1
Summary of Measured Noise Levels – 03/03/22 - 07/03/22 – free field, dB

Location	Date	Period	Time (h)	L _{Aeq, T}	L _{A10}	L _{A90}	L _{AFMax}
1	03/03/22	Daytime	1100-2300	58.2	59.8	52.3	85.9
	03/03/22-04/03/22	Night-time	2300-0700	53.6	54.3	48.1	79.7
	04/03/22	Daytime	0700-2300	61.1	60.7	51.4	92.6
	04/03/22-05/03/22	Night-time	2300-0700	53.3	54.3	44.0	81.1
	05/03/22	Daytime	0700-2300	58.3	57.3	48.5	92.5
	05/03/22-06/03/22	Night-time	2300-0700	51.0	50.6	42.5	80.2
	07/03/22	Daytime	0800-1200	57.4	55.7	46.5	100.0
2	03/03/22	Daytime	1100-2300	58.2	60.1	53.6	87.4
	03/03/22-04/03/22	Night-time	2300-0700	54.2	56.9	48.1	76.4
	04/03/22	Daytime	0700-2300	58.0	59.4	52.9	91.5
	04/03/22-05/03/22	Night-time	2300-0700	53.7	56.6	46.7	75.3
	05/03/22	Daytime	0700-2300	55.1	57.4	50.3	82.8
	05/03/22-06/03/22	Night-time	2300-0700	52.0	54.4	45.2	81.0
	07/03/22	Daytime	0800-1200	54.8	56.8	49.3	78.6

Table 4.2
Summary of Measured Vibration Levels – 09/03/22-10/03/22

Location	Date	Period	Time (h)	Max VDV m/s ^{-1.75}
3	09/03/22	Daytime	1407-2300	0.025
	09/03/22-10/03/22	Night-time	2300-0700	0.020
	10/03/22	Daytime	0700-1317	0.017

4.3 Observations and Comments

During the attended portions of the survey, the acoustic environment during the daytime at all measurement locations consisted of the surrounding road traffic noise with occasional noise from passing trams to the northern boundary.

5.0 ASSESSMENT

5.1 Predicted Internal Noise Levels within Dwellings

5.1.1 In-Façade Noise Mitigation

Calculations of internal noise levels have been completed for the proposed development to demonstrate that suitable internal noise levels can be achieved within the most noise exposed rooms.

The calculation procedure used within this assessment has been derived from Annex G.2 *Typical design problem: more rigorous calculation* of BS 8233:2014:

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left(\frac{S_1}{S} 10^{\frac{-R_1}{10}} + \frac{S_2}{S} 10^{\frac{-R_2}{10}} \dots + \frac{S_n}{S} 10^{\frac{-R_n}{10}} \right) + 10 \log_{10} \left(\frac{S_{total}}{A} \right) + 3$$

Where:

$L_{eq,ff}$ is the equivalent continuous sound pressure level incident upon the room element under consideration;

S_n is the surface area of each building element ‘n’ for any given façade;

R_n is the sound reduction performance, per frequency band, of building element ‘n’;

S_{total} is the surface area of all external façades under consideration;

A is the equivalent absorption area of the receiving room being considered.

For the purpose of this assessment, the values of ‘A’ have been derived from previously utilised reverberation times undertaken by Dragonfly Consulting for a similar development, considered to be representative of a typical furnished living room.

The area of external façade that is glazed and unglazed has been calculated using the following drawings produced by Day Architects:

- 1284 21-DAY-01-GF/01/02/ZZ-DR0-A-22-0001 to 0013 – Floor Plans;
- 1284 21-DAY-A-31-511 to 532 Curtain Wall Type Elevations.

For these dwellings, it has been assumed that the Daytime and Night-time data obtained at the measurement locations will be representative of the acoustic environments.

It is understood that the proposals include provision for alternative ventilation in the form of a Mechanical Ventilation and Heat Recovery (MVHR) system, to allow appropriate levels of ventilation by means other than opening the windows in accordance with the guidance within ‘Part F’ of the *Building Regulations 2010*.

The following external (unglazed) façade construction has been assumed:

- 15mm brickwork slip on adhesive layer bonded back to mineral wool insulation on 12mm sheathing board and 100mm SFS via a rail fixing system, lined internally with 2 no. layers 15mm Gyproc Soundbloc.

The following performance would be expected from the external façade construction:

Table 5.2
SRI of Façade, dB (R_w)

Frequency in Hz	125	250	500	1000	2000
SRI of Façade	44	48	51	54	58

Four glazing units have been presented by the client:

- System Reference G1:
 - 6mm toughened glass;
 - 16mm cavity;
 - 6mm toughened glass.
- System Reference G2:
 - 6mm toughened glass;
 - 16mm cavity;
 - 10mm toughened glass
- System Reference G3:
 - 10mm toughened glass;
 - 12mm cavity;
 - 6mm toughened glass.

The stated sound reduction performance of the above glazing units is shown in Table 5.3:

Table 5.3
SRI of Glazing, dB (R_w)

System Reference	Octave Band Centre Frequency, Hz					R _w	C; C _{tr}
	125	250	500	1000	2000		
G1	22.0	24.0	31.0	38.0	36.0	34	-1; -4
G2	25	26	35	41	41	38	-2;-5
G3	26	27	34	40	38	38	-2;-5

A summary of the glazing recommendations is shown below for each block, per façade and per floor:

Table 5.4
Summary of Glazing Specifications – Block B1

Level	Glazing Ref.
1-2	G1
3-29	G2/G3

Table 5.5
Summary of Glazing Specifications – Block B2

Level	Glazing Ref.
1-2	G1
3-23	G2/G3

It has been calculated that, given the above façade constructions with the stated specifications of double glazing, the internal noise levels would be as follows:

Table 5.6
Highest Internal Levels in Rooms – Block B1, dB(A)

Daytime, $L_{Aeq,16h}$ (0700-2300)	Night-Time, $L_{Aeq,8h}$ (2300-0700)	Typical Maxima, L_{AFMax}	Highest Maxima, L_{AFMax}	Within Adopted Criteria? Y/N
North Side Level 1 to Level 2				
21.4	15.7	39.6	42.5	Y
North Side Level 3 to Level 29				
23.3	18.1	42.0	44.9	Y
South Side Level 1 to Level 2				
20.7	19.4	28.8	44.9	Y
South Side Level 3 to Level 29				
22.7	21.8	31.3	47.3	Y

Table 5.7
Internal Levels in Rooms – Block B2, dB(A)

Daytime, $L_{Aeq,16h}$ (0700-2300)	Night-Time, $L_{Aeq,8h}$ (2300-0700)	Typical Maxima, L_{AFMax}	Highest Maxima, L_{AFMax}	Within Adopted Criteria? Y/N
North Side Level 1 to Level 2				
21.4	15.7	39.6	42.5	Y
North Side Level 3 to Level 29				
23.3	18.1	42.0	44.9	Y
South Side Level 1 to Level 2				
20.7	19.4	28.8	44.9	Y
South Side Level 3 to Level 29				
22.7	21.8	31.3	47.3	Y

Table 5.6 and 5.7 show that, when assessed against BS 8233:2014 and utilising the proposed design scheme, the $L_{Aeq,16h}$ (daytime), $L_{Aeq,8h}$ (night-time) and L_{AFMax} internal noise levels meet the standard proposed by Dragonfly Consulting for all rooms.

5.2 Assessment of Human Response to Vibration

The guidance within BS 6472:2008 states the following:

“If, during any assessment period, there is a total of N vibration episodes of various durations t_n each with a vibration dose value of $VDV_{b/d,tn}$ the total vibration dose value for the day or night period is given by Equation 3.”

(3)

$$VDV_{b/d,day/night} = \left(\sum_{n=1}^{n=N} VDV_{b/d,t_n}^4 \right)^{0.25}$$

As such, the VDV within each assessment time interval (daytime, 0700h-2300h; night-time, 2300h-0700h) has been determined for each axis via summation of the VDV_{10s} within the relevant periods throughout the vibration survey. These are shown in Table 5.8 below:

Table 5.8
Summary of $VDV_{b/d,day/night}$ per axis, $m/s^{1.75}$

Date	Period	Maximum Measured VDV
09/03/22	1407-2300	0.024
09/03/22-10/03/22	2300-0700	0.021
10/03/22	0700-1317	0.017

The measured vibration levels have been assessed against the guidance contained in BS 6472:2008 to determine the likely response of future occupants of the proposed dwellings. The vibration levels were measured at the existing building line; this location is considered to be representative of the nearest dwelling associated with the proposed site.

As the guidance within BS 6472:2008 is reflective of the point of entry into a human receptor, not at the measurement position, it is therefore considered appropriate to estimate the effect that the proposed building will have on the magnitude of vibration at the point of entry to the human receptors.

When accounting for the effect that the building structure would have on the measured vibration levels, the following should be considered:

- A reduction in levels as vibration passes into and is subsequently dampened by the foundations of a building;
- An amplification in levels as the vibration propagates up the building to the upper storeys and across potentially suspended floors.

To estimate the measured vibration levels at the point of entry to a human receptor on a suspended upper storey, an amplification factor of 2.8 has been used. This is based on figures presented in Transmission of Ground-borne Vibration in Buildings (Jakobsen, J. (1989) Journal of Low Frequency Noise and Vibration, Vol. 8 No. 3). To assess against a worst-case scenario, no reduction in vibration levels due to the proposed building foundations has been accounted for.

Table 5.9 below shows the likely vibration levels within a habitable room located on the upper storey of a residential property near to the tram line.

Table 5.9
Estimated Vibration Dose Values (eVDV) at Upper Storey of Nearest Proposed Dwelling, ms^{-1.75}

Period	Period	Maximum measured VDV	Transfer Function	Resulting eVDV	Probability of adverse comments on vibration.
Daytime	1407-2300	0.024	2.8	0.068	Less than a low probability of adverse comment
Night-time	2300-0700	0.021	2.8	0.058	
Daytime	0700-1317	0.017	2.8	0.049	

The highest estimated Vibration Dose Value throughout the measurement period across all three axes was below the lowest criteria for ‘low probability of adverse comment’ for both daytime and night-time periods within a residential property. Therefore, it is considered that the vibration levels due to activities from the tram line to the will be unlikely to cause adverse comment.

5.3 Uncertainty of the Assessment

Following current good practice, an appraisal of the uncertainty within both the on-site noise survey and the prediction calculations has been completed.

The following negative factors have been noted in considering the uncertainty of the on-site noise survey:

- Sound level meter located at second floor height.

The following positive factors have been noted in considering the uncertainty of the on-site noise survey:

- Low winds and no precipitation;
- Monitoring period of greater than 24 hours.

As such, it is considered that the uncertainty for the on-site noise survey element of the work is $\pm 2\text{dB}$.

It is considered that the uncertainty for the prediction elements of the work should be considered in line with the normal use of ISO 9613-2 based point source propagation calculations and, as such, a correction of $\pm 3\text{dB}$ has been applied.

Using the root sum of squares method, this gives a combined uncertainty for this assessment of $\pm 3.6\text{dB}$.

5.4 Assertion of Competence

This assessment has been completed by Chris Chittock, Managing Director of Dragonfly Consulting with direct responsibilities for the acoustics projects within the firm.

I hold a Bachelor of Science Degree, with Honours, in Audio Technology from the University of Salford. I am a Corporate Member of the Institute of Acoustics. I have over 19 years of experience within the field of acoustics in both the public and private sector.

I have undertaken numerous assessments against BS 8233:2014 and BS 6472:2008 and assert that I am competent to undertake this assessment.

6.0 CONCLUSIONS

RG Group has appointed Dragonfly Consulting to carry out a Noise Impact Assessment in support of a condition discharge relating to their site at Portugal Street East, Manchester.

The noise assessment has been conducted with reference to the National Planning Policy Framework and the requirements of the extant planning permission.

This report therefore describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria. Recommendations are also made with respect to the design of the development.

Measurement of external noise levels has been completed for the proposed development to allow demonstration by calculation that suitable internal noise levels will be achieved within the most noise exposed rooms.

The assessment shows that, when assessed against the requirements of BS 8233:2014, the proposed glazing strategy would be suitable to achieve the necessary internal levels within all noise sensitive rooms.

Furthermore, the assessment demonstrates that vibration generated by the operation of the tram line will result in a ‘low probability of adverse comment’.

Appendix A – Glossary of Terminology

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A-1
Sound Levels Commonly Found in the Environment

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

Acoustic Terminology

dB (decibel) The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2×10^{-5} Pa).

dB(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq} This is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L₁₀ & L₉₀ If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. L₁₀ is the level exceeded for 10% of the time and is often used as a descriptor for road traffic noise. Similarly, L₉₀ is the level exceeded for 90% of the time and is often used to describe the background level. It is common practice to use the L₁₀ index to describe traffic noise.

L_{AMax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{AMax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment.

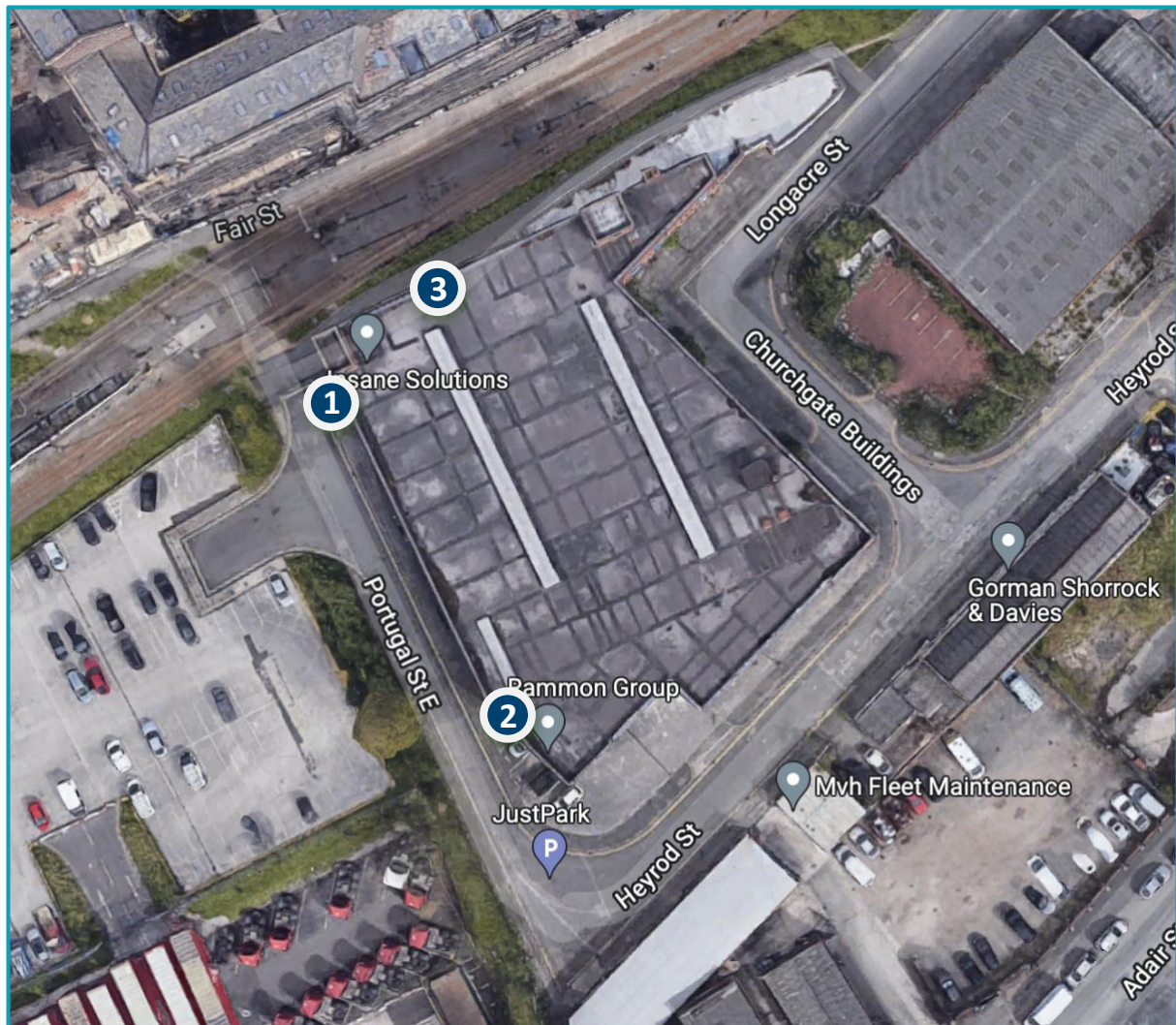
Appendix B – Monitoring Equipment

Table B-1
Noise Monitoring Equipment

Equipment	Serial Number
01dB Fusion Sound Level Meter	12823
G.R.A.S 40CD Microphone	415839
01dB PRE22N Preamplifier	2004181
01dB Fusion Sound Level Meter	12298
G.R.A.S 40CD Microphone	332011
01dB PRE22N Preamplifier	1936193
Rion VM-56 Vibration Meter	00680056
Castle GA607 Acoustic Calibrator	043074

Appendix C – Measurement Locations

Figure C-1
Measurement Location Plan



Measurement Locations