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One City Road, Manchester

Environmental Noise Study

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CONTENTS

1.0 SUMMARY 2

2.0 INTRODUCTION 3

3.0 DESCRIPTION OF SITE 5

4.0 DESCRIPTION OF PROPOSED DEVELOPMENT 7

5.0 RELEVANT GUIDANCE DOCUMENTS 8

6.0 ENVIRONMENTAL NOISE SURVEYS 16

7.0 IDENTIFICATION AND EVALUATION OF LIKELY SIGNIFICANT EFFECTS 19

8.0 NOISE EGRESS FROM COMMERCIAL UNIT 26

9.0 EXTERNAL NOISE LEVELS DUE TO BUILDING SERVICES 29

Table 1: Example threshold of potential significant effect at dwellings 9
Table 2: Summary of construction noise impact magnitude 11
Table 3: Guidance on Effects of Vibration Levels 11
Table 4: Transient vibration guide values for cosmetic damage 12
Table 5: BS4142: 2014 Assessment Method 14
Table 6: Summary of measured environmental noise levels 18
Table 7: Threshold noise values for potential significant effect due to construction 20
Table 8: Calculated noise levels at sensitive receptors during construction phases 21
Table 9: Calculated excess over threshold noise values for potential significant effect, no mitigation 22
Table 10: Maximum allowable external music noise levels due to commercial units at One, City Road 26
Table 11: Maximum allowable daytime internal noise levels within the commercial unit, doors closed 27
Table 12: Maximum allowable night time internal noise levels within the commercial unit, doors closed 27
Table 13: Maximum allowable daytime internal noise levels within the commercial unit, doors open 28
Table 14: Maximum allowable night time internal noise levels within the commercial unit, doors open 28
Table 15: Environmental noise limits for non-emergency building services plant 29
Table 16: Environmental noise limits for emergency building services plant 30

Figure 1: Site location plan 6
Figure 2: Noise survey measurement locations 17

1.0 SUMMARY

Fisher Acoustics Ltd has been commissioned by Marshall Commercial Development Projects Limited to conduct an environmental noise study relating to a proposed office development at One City Road, Manchester.

Environmental noise measurements around the proposed site have identified the pre-existing environmental noise levels during the day and night at noise sensitive receptors.

Appropriate environmental noise limits during the construction phase of the proposed development have been established.

Overall environmental noise limits have also been recommended for building services plant serving the development and for a proposed commercial unit within the proposed development.

2.0 INTRODUCTION

Fisher Acoustics Ltd has been commissioned by Marshall Commercial Development Projects Limited to conduct an environmental noise assessment relating to a proposed office development at One City Road, Manchester.

This report identifies the results of environmental noise surveys previously undertaken around the site and the determination of suitable environmental noise limits for the proposed development during the construction and operation phases.

The steps undertaken in compiling this study are as follows:

- Review of daytime and night time external noise survey data to determine the typical pre-existing levels of noise at noise sensitive receptors around the site during daytime and night time periods
- Setting of appropriate construction noise limits
- Calculation of potential construction noise levels from the proposed development
- Determination of suitable overall noise limits for building services plant to safeguard residential amenity
- Determination of suitable noise limits for a commercial unit within the proposed development to safeguard residential amenity

Ordinarily an environmental noise assessment relating to a proposed office development would involve the carrying out of an external noise survey to determine the pre-existing noise levels at and surrounding the development site due to typical external noise sources. However, due to reduced road traffic volumes and general activity in line with government guidelines relating to the ongoing Coronavirus pandemic, it is not considered possible to obtain representative noise levels at noise sensitive receptors around the proposed development site at the current time.

Therefore, and in accordance with guidance published by the Association of Noise Consultants [ANC] and the Institute of Acoustics [IOA] 'Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments', in order to establish appropriate environmental noise limits for the proposed development, this report references the results of previous environmental noise surveys undertaken by Fisher Acoustics Ltd around the development site.

These previous surveys were conducted as part of a planning application for a development on Medlock Street. This approach has been discussed and agreed with Rick Knightley, Environmental Protection Manager at Manchester City Council.

3.0 DESCRIPTION OF SITE

General Site Description

The site lies on the periphery of Manchester city centre central business district and currently comprises office buildings and adjacent car parking. The site is located at the junction of City Road East and Medlock Street.

The site is bounded by City Road East to the north, Medlock Street to the west, River Street to the south and Shortcroft Street to the west.. To the north of the site on City Road East is The Nile apartment building. To the west lies the City South apartment building on Shortcroft Street. To the south of the proposed site is the Premier Inn on River Street. To the east of the proposed site, on the opposite side of Medlock Street lie offices, a hotel, retail units and a theatre & cinema.

The Mancunian Way (A57(M)) is located approximately one hundred and thirty metres to the south of the proposed development site.

Medlock Street is a busy road trafficked by passenger vehicles, goods vehicles, motorbikes and buses. City Road East, Shortcroft Street and River Street are relatively lightly trafficked The A57(M) is a very busy arterial route that is heavily trafficked by lorries, cars, vans and buses.

Figure 1 shows the site location plan and identifies the closest noise sensitive receptors around the site.

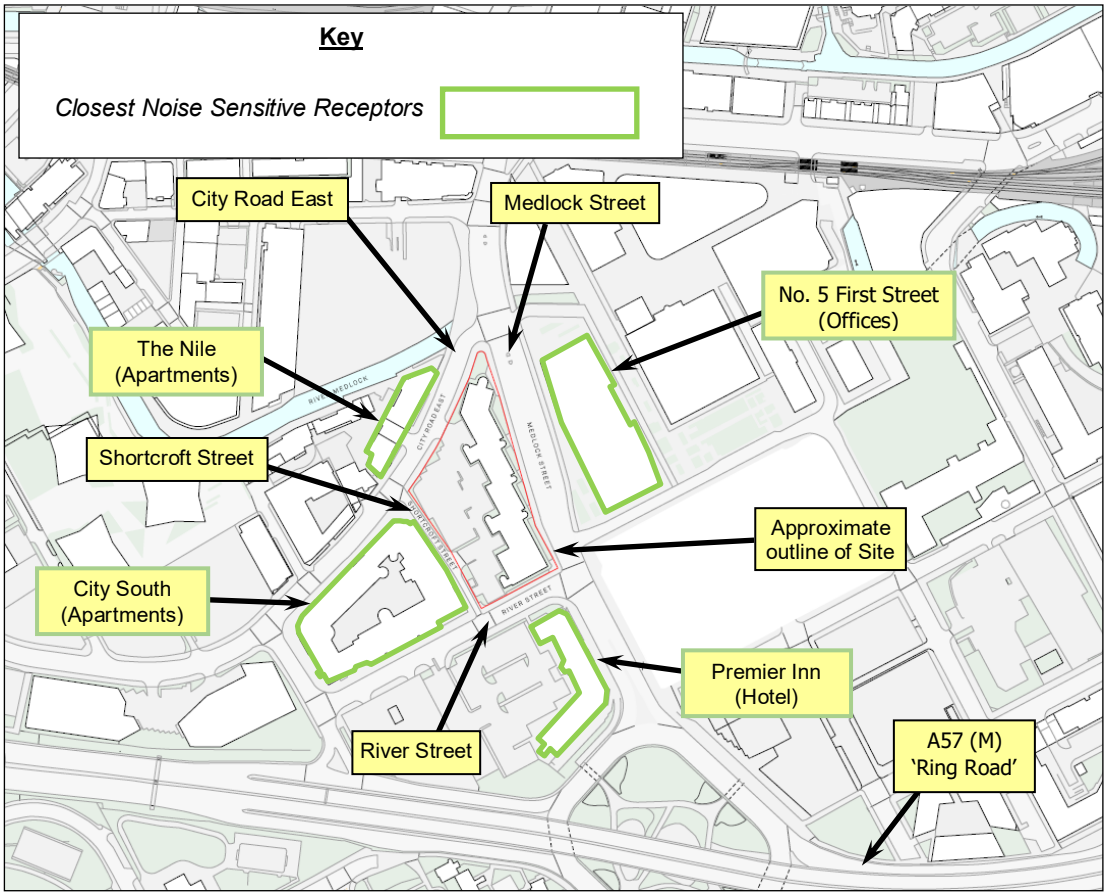


Figure 1: Site location plan

4.0 DESCRIPTION OF PROPOSED DEVELOPMENT

General Development Description:

The proposed development is to provide two new office buildings. Block 1 is a fourteen storey building with office space, a commercial unit and ancillary space. Block 2 is an eleven storey building with office space and associated ancillary space.

The proposed uses within the Block 1 building are as follows:

- Basement: Plant room, store rooms, cold water tank room, Wet riser tank room
- Ground Floor: Reception area, flexible shared office workspace, lifts and lobby areas, Service bay, Office refuse, Male & Female WC, Accessibility WC, Cleaners Store room, drying rooms, Parcel Store, comms room, substation, Switch room, Staff welfare, Security room, Cycle store, Commercial Unit (approx. floor area 56 m2, intended as coffee shop, small restaurant)
- Level 1 to Level 13: Office space, Male & Female WC, Accessibility WC, Cleaners Store room, external balconies
- Level 14: Internal Plant room, External plant area, Communal Amenity, External Terrace Male & Female WC, Accessibility WC

The proposed uses within the Block 2 building are as follows:

- Basement: Plant room, store rooms
- Ground Floor: Reception area, flexible shared office workspace, lifts and lobby areas, Security room, Staff welfare room, comms room, parcel store, office refuse, switch room, service bay area, Substation, Gas, Male & Female WC, Cleaners Store room, Accessibility WC, Male shower & changing area, Female shower & changing area, Drying rooms, Cycle spaces
- Level 1 to Level 10: Office space, Male & Female WC, Accessibility WC, Cleaners Store room, external balconies
- Level 11: Internal Plant room, External plant area, Communal Amenity, External City View Terrace Male & Female WC, Accessibility WC, Cleaners Store room

5.0 RELEVANT GUIDANCE DOCUMENTS

The National Planning Policy Framework (NPPF), published in March 2012 by the Department for Communities and Local Government and updated most recently in February 2019, supersedes previous Planning guidance documents, such as PPG 24 'Planning and Noise'. The NPPF 'sets out the Government's planning policies for England and how these are expected to be applied'.

Clause 170 of the National Planning Policy Framework states that Planning policies and decisions should contribute to enhance the natural and local environment by 'preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability'.

Clause 180 of the National Planning Policy Framework states that '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:

a) 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; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

The National Planning Policy Framework document cross references the 'Explanatory Note to the Noise Policy Statement for England'. The 'Noise Policy Statement for England' (NPSE) was published by the Department for Environment Roof and Rural Affairs in March 2010.

The NPSE does not give suggested external noise criteria for developments. In the absence of specific criteria in the NPSE, reference shall be made in this document to established guidance and principles, as established in British Standards and the local planning guidance documents.

Construction Noise and Vibration

Annex E of BS 5228-1: 2009+A1:2014 'Code of Practice for noise and vibration control on construction and open sites' provides guidance on significance criteria for construction noise.

Example Method 1 within Annex E, termed the 'ABC Method' is for residential receptors only and allows the setting of threshold noise levels above which a potential significant effect could be generated. For the appropriate period (night, evening/weekends or day), the pre-existing ambient noise level is determined and rounded to the nearest 5 dB. This noise level is then compared with the noise level at the receptor in question due solely to site operations. If the noise level originating from the site exceeds the appropriate category value, then a potential significant effect is indicated. Other project-specific factors, such as the number of receptors affected and the duration and character of the impact then need to be taken into consideration to determine if there is a significant effect. Table 1 gives the threshold values and explains how the method is applied.

Assessment category and threshold value period	Threshold value (dB LAeq, T)		
	Category A [A]	Category B [B]	Category C [C]
Night time (23.00 - 07.00)	45	50	55
Evening and weekends [D]	55	60	65
Daytime (07.00 – 19.00)	65	70	75

Table 1: Example threshold of potential significant effect at dwellings

NOTE 1: A potential significant effect is indicated if the LAeq, T noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total LAeq, T noise level for the period increases by more than 3 dB due to site noise.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.
D) 19.00 – 23.00 weekdays, 13.00 – 23.00 Saturdays and 07.00 – 23.00 Sundays

Example Method 2 within Annex E states that noise generated by construction activities of duration of one month or more is deemed to be potentially significant if the total noise (pre-construction ambient noise plus construction noise) exceeds the pre-construction ambient noise level by 5dB or more, subject to lower cut-off values during daytime, evening and night of 65dB, 55dB and 45dB LAeq respectively.

The criteria stated within example method 2 are generally applicable to the following building types:

- Residential
- Hotels and hostels
- Religious
- Education
- Health and/or community

For office and residential buildings, BS5228-1: 2009+A1:2014 refers to the 1976 revision of Advisory Leaflet 72 'Noise control on building sites, published by the Department of the Environment, which states 'Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut…..Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise
- 75 dB(A) in urban areas near main roads in heavy industrial areas'.

These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments, and when working outside normal working hours, such as between 19.00 and 22.00 hours, the allowable noise levels from building sites will be less. A reduction of 10 dB(A) may often be appropriate'.

With reference to the above discussions, Table 2 summarises the suggested significance criteria for the rating of construction noise affecting the noise sensitive premises around the Site.

Negligible	Minor	Moderate	Major
Site noise is equal to the threshold value	Site noise is 3dB to 5dB greater than the threshold value	Site noise is 5dB to 10dB greater than the threshold value	Site noise is more than 10dB greater than the threshold value

Table 2: Summary of construction noise impact magnitude

Human Response to Vibration

Section B.2 and Table B.1 of Annex B of BS 5228-2: 2009+A1: 2014 'Code of practice for noise and vibration control on construction and open sites – Vibration' provides guidance on human response to vibration. The vibration levels at which different effects may be perceived and their impact magnitude are summarised in Table 3.

Vibration Level (PPV)	Effect	Impact Magnitude
0.14 mm·s^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Negligible
0.3 mm·s^{-1}	Vibration might be just perceptible in residential environments.	Minor Adverse
1.0 mm·s^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents	Moderate Adverse
10 mm·s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level	Major Adverse

Table 3: Guidance on Effects of Vibration Levels

Vibration Effects on Buildings

Section B.3 and Table B.2 of Annex B of BS 5228-2: 2009+A1: 2014 'Code of practice for noise and vibration control on construction and open sites – Vibration' identifies the transient vibration levels above which cosmetic damage could occur. The guideline levels are reproduced in Table 4:

Line (See Figure B1 within Appendix B)	**Type of Building**	**Peak Component Particle Velocity in Frequency Range of Predominant Pulse**	
		4 Hz to 15 Hz	**15 Hz and above**
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
2	Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Table 4: Transient vibration guide values for cosmetic damage

NOTE 1: Values referred to are at the base of the building.
NOTE 2: For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded

Building Service Plant Noise

BS4142: 2014

For noise of an industrial nature such as fixed building services plant, an assessment of the likely effects on people inside or outside residential buildings due to noise can be carried out using BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'.

The following acoustic parameters are described within BS4142: 2014:

- Specific Noise Level – the equivalent continuous A-weighted sound pressure level measured over a specified time period, Tr, at the assessment position with the specific noise source contribution, $L_{Aeq, Tr}$ (i.e. the noise level due to the new noise source).
- Rating Level – the Specific Noise Level plus an adjustment for any characteristic noise features, $L_{Ar, Tr}$
- Residual Noise Level – the equivalent continuous A-weighted sound pressure level measured when the specific noise does not contribute to the ambient noise
- Background Noise level – measured for a specific duration, T, in the absence of the specific noise source, $L_{A90,T}$

To complete a BS4142 assessment of potential noise effects upon residential properties, it is necessary to obtain the Rating Level due to the sound source in question. The rating level is derived by adding corrections to the measured Specific Noise Level, if the noise source, at the noise sensitive receptors in question:

- is tonal (correction of 0dB to +6dB, depending on severity)
- contains distinct impulses (correction of 0dB to +9dB, depending on severity)
- is intermittent (correction of +3dB if applicable)
- is otherwise distinctive against the residual acoustic environment (correction of +3dB)

For instance, where the noise from a particular sound source is strongly tonal and impulsive at any noise sensitive receptor over the duration of the appropriate assessment period, a maximum correction of +15 dB may apply.

The rating level can then be used in order to ascertain the *likelihood of complaints* due to industrial noise disturbance by subtracting the measured background noise level. The greater the positive difference, the greater the likelihood of complaints.

Table 5 summarises the assessment method.

Difference between Rating Level and Measured Background Level	Assessment
+10 dB or greater	Significant adverse impact
+5 dB	Indication of adverse impact, depending on context
0 dB or less	Indication of low impact, depending on context

Table 5: BS4142: 2014 Assessment Method

Where a new noise source has not yet been introduced, a recommended specific noise level can be determined based on a knowledge of the existing background noise level.

BS 4142: 2014 recognises that where background and rating levels are low, the potential absolute noise levels at the sensitive receptor might be more relevant in assessing potential impact than a simple comparison of the rating level and background noise level.

In such instances, reference can be made to BS 8233: 2014 in order to determine appropriate external noise levels due to buildings services plant, such that acceptable noise levels are achieved inside buildings.

Planning & Noise, Technical Guidance - Manchester City Council

'Planning & Noise, Technical Guidance' issued by Manchester City Council in December 2015 gives guidance on the preferred approach to environmental noise assessments. With regard to external noise due to building services plant, Section 3.6.1.5.1 of the document states:

- 'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location'.

Noise from Commercial Operations

Noise egress from the proposed commercial unit at the Proposed Development must be controlled to appropriate levels so as to avoid noise nuisance to existing sensitive receptors.

With regard to entertainment venues, 'Planning & Noise, Technical Guidance' issued by Manchester City Council in December 2015 states:

- 'When considering the potential impact of a proposal for an entertainment venue, consultants should consider the overall noise level (LAeq) and the 63 Hz and 125 Hz octave band noise levels (Leq). Music noise in the 63 Hz and 125 Hz octave bands, which is often described as "bass noise", is particularly difficult to contain and the impulsive character of this low frequency music noise is particularly disturbing for local residents exposed to it'.

- 'A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open. The criterion here is:

  Entertainment noise (LAeq) should be controlled to 10dB below the background noise level (LA90) without the entertainment noise present, in each octave band at the nearest noise sensitive location'.

No criteria are given in the published guidelines in relation to noise egress from the internal office areas. This follows from the fact that internal noise levels within offices typically lie between 50dB LAeq and 60 dB LAeq. Double glazed units typically achieve a minimum sound reduction of approximately 30dB Rw and noise breakout levels from an office only five metres from the office façade do not normally exceed approximately 20dB LAeq. This level of noise of noise is much lower than typical levels of background noise in an urban setting. Office noise is therefore normally inaudible external to the office buildings in urban areas such as the development Site.

6.0 ENVIRONMENTAL NOISE SURVEYS

As discussed above, due to reduced road traffic volumes and general activity in line with government guidelines relating to the ongoing Coronavirus pandemic, it is not considered possible to obtain representative noise levels at the noise sensitive receptors around the proposed development site.

Reference has therefore been made to the results of previous environmental noise surveys undertaken by Fisher Acoustics Ltd around the development site in order to establish appropriate environmental noise limits. The surveys formed part of an approved planning application (planning reference 108963/FO/2015/C1).

The previous noise surveys of the noise environment at the sensitive receptors around the site were carried out over typical weekday daytime and night time periods on Tuesday 17th March 2015 and Wednesday 18th March 2015.

The measurement locations used for the surveys are identified on Figure 2 and are representative of the positions of noise sensitive receptors around the site. The measured noise levels can therefore be used to determine acceptable levels of noise at the existing sensitive properties around the site due to noise during the construction and operation phases of the development.

The measurement locations were as follows:

- Location 1: At No. 8 First Street, Medlock Street
- Location 2: At No. 8 First Street Medlock Street
- Location 3: At location of rear façade of No. 8 First Street
- Location 4: At VITA residential building
- Location 5: At Premier Inn hotel
- Location 6: At The Nile residential building
- Location 7: At Hill Quays residential building
- Location 8: At Innside hotel
- Location 9: At City South residential building

Full survey details are given in Appendix A. Appendix A also contains a summary of the results obtained from the surveys.

The long-term noise environment at and around the Application Site is determined by road traffic on Medlock Street, Albion Street, Whitworth Street West and the Mancunian Way.

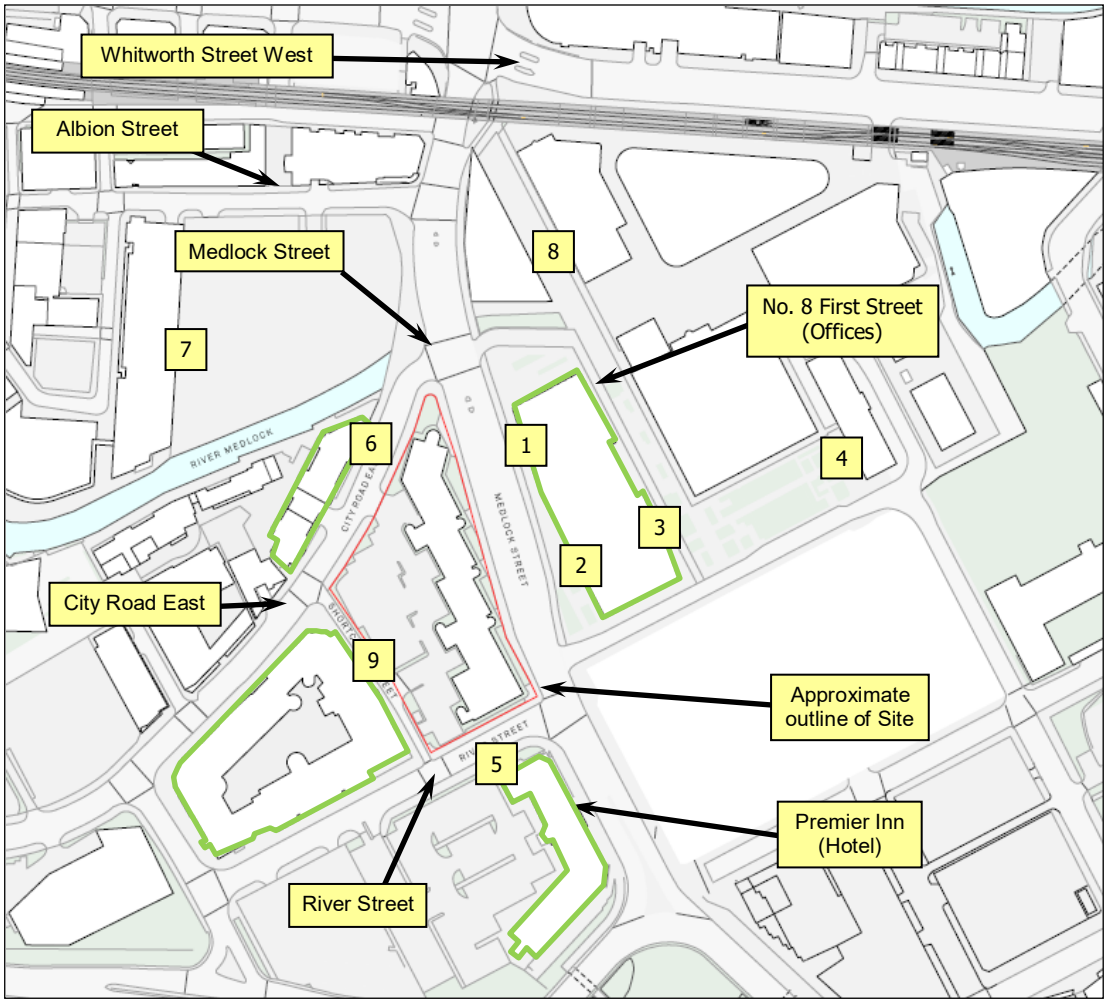


Figure 2: Noise survey measurement locations

The measured noise levels during the day and night at and around the Site are summarised in Table 6.

Location	Measured Noise Level					
	Daytime (Defined as 0700 to 2300)			Night time (Defined as 2300 to 0700)		
	dB, L_{Aeq}	dB, L_{Amax}	dB L_{A90}	dB, L_{Aeq}	dB, L_{Amax}	dB L_{A90}
1: No. 8 First Street	70	74 to 83	60 to 65	-	-	-
2: No. 8 First Street	67	72 to 78	59 to 63	-	-	-
3: No. 8 First Street	62	64 to 79	57 to 60	-	-	-
4: VITA residential	58	63 to 81	55 to 56	51	55 to 64	46 to 48
5: Premier Inn hotel	65	69 to 76	61 to 62	60	67 to 71	57 to 59
6: The Nile residential	65	78 to 80	55 to 59	57	62 to 79	45 to 46
7: Hill Quays residential	53	60 to 69	49 to 50	47	52 to 62	43 to 44
8: Innside hotel	60	68 to 81	53 to 56	53	58 to 72	44 to 48
9: City South residential	58	62	56	52	59 to 64	48 to 50

Table 6: Summary of measured environmental noise levels

It should be noted that the statistical noise levels ('L_{Amax}' and 'L_{A90}') given in Table 6 show the range of noise levels measured over the sample periods. The quoted average (L_{Aeq}) noise levels are the average noise levels measured over the full sampling period at each measurement position.

7.0 CONSTRUCTION NOISE AND VIBRATION

Noise Sensitive Receptors

There are a number of potentially sensitive receptors around the Site during the Construction phase. The closest noise sensitive receptors to the Site are (as identified on Figure 1):

- The Nile - Residential Dwellings on City Road East.
- City South – Residential Dwellings on Shortcroft Street and City Road East
- Premier Inn - Hotel on Medlock Street
- No. 8 First Street – Offices on Medlock Street

Demolition and Construction Noise

There is the potential for environmental noise effects at the above receptors from the following during the construction phase of the project:

1. Temporary addition to traffic flows on local roads due to construction traffic
2. Construction of proposed development

Construction noise impact at the following sensitive receptors has been assessed:

A. The Nile - Residential Dwellings on City Road East, 18 metres from the Site boundary
B. City South – Residential Dwellings on Shortcroft Street and City Road East, 6 metres from the Site boundary
C. Premier Inn - Hotel on Medlock Street, 22 metres from the Site boundary
D. No. 8 First Street - Offices on Medlock Street, 26 metres from the Site boundary

The identified distances above are the distances from each receptor to the closest point of the Site to that receptor.

Whilst there are other receptors around the Site, these other receptors are at greater distances from the Site than the receptors identified above and with similar exposure to the existing noise sources in the areas. Therefore, the achievement of acceptable noise levels at the assessed receptors would lead to acceptable noise level at receptors at a further distance from the Site.

With reference to the guidance discussed above and the results of the noise surveys, the threshold values for potential significant effects are as given in Table 7.

Location	Threshold Values, Daytime dB, L_{Aeq}
A: The Nile, City Road East	70
B: City South, Shortcroft Street/ City Road East	70
C: Premier Inn, Medlock Street	70
D: No. 8 First Street, Medlock Road	75

Table 7: Threshold noise values for potential significant effect due to construction

In order to estimate the likely levels of noise from construction activities at the Site, calculations have been carried out using the methodologies and data given in BS5228: 2009+A1:2014 'Code of Practice for noise and vibration control on construction and open sites; Part 1 - Noise' and by applying corrections for distance attenuation (i.e. by how much noise reduces with increasing distance from the plant).

This exercise has been carried out for each major construction phase of the project in order to calculate the worst case hourly noise level (LAeq,1hour) at each receptor.

For large construction vehicles that will travel to and from the Site, additional calculations have been carried out for the maximum number of expected movements per hour, speed and average travel distance from each receptor.

The construction works will involve the operation on the Site of major plant items at certain stages of the construction works; examples are set out below:

- Excavators (2 no.);
- Pneumatic breakers;
- Pile cropper;
- Dumper trucks (2 no.);
- Continuous flight auger or rotary bored piling rigs (2 no.);
- Concrete pumps;
- Poker vibrators;
- Tower cranes (2 no.);
- Telehandler.

With regard to construction traffic such as concrete deliveries, it has been advised that in the worst case, there would be approximately twenty vehicle movements to or from the Site per

working day i.e. approximately two vehicles per hour to arrive and offload and then depart. The typical number of vehicle movements would be validated by the Applicant during the detailed design and construction planning phase before being formalised within a detailed Construction Management Plan.

Table 8 identifies the calculated noise levels at the receptors identified above due to cumulative noise from construction noise sources at the Site during the main construction phases. The Table presents the worst case cumulative noise level on the assumption that all of the noisier mobile items of construction plant are situated at the section of the Site perimeter that is closest to the receptor in question. This situation will not prevail for an extended period of time, as the construction plant will move around the Site as each section of the works is completed.

In addition, the typical expected noise level is presented given the location of plant items at more typical distances from the nearby receptors. It should be noted that the calculations at this stage do not include for any beneficial acoustic screening provided by any solid hoarding around the Site or by the local screening of individual plant items. An 'on' time of construction noise sources during each day of 50% has been assumed during the excavation and piling stage, and of 70% during the frame construction.

Receptor	**Calculated Noise Levels During Construction Phase (dB LAeq)**		
	Demolition 6 months Worst case/ Typical	**Excavation & Piling 5 months Worst case/ Typical**	**Frame Construction 16 months Worst Case/ Typical**
A: The Nile, City Road East (Residential)	80/74	75/73	75/72
B: City South, Shortcroft Street/ City Road East (Residential)	80/72	77/70	79/70
C: Premier Inn, Medlock Street (Commercial/ Residential)	79/74	75/70	73/68
D: No. 5 First Street, Medlock Road (Office)	76/73	74/71	74/72

Table 8: Calculated noise levels at sensitive receptors during construction phases

At other stages of the construction programme, the expected noise levels at the sensitive receptors will be lower than those given in Table 8, depending upon the ongoing processes and the stage of the build programme.

Table 9 shows the calculated excess over the threshold noise values for potential significant effect due to construction, if no mitigation measures are in place.

Receptor	Calculated Noise Levels During Construction Phase (dB LAeq)		
	Demolition 6 months Worst case/ Typical	**Excavation & Piling 5 months Worst case/ Typical**	**Frame Construction 16 months Worst Case/ Typical**
A: The Nile, City Road East (Residential)	10/4	5/3	5/2
B: City South, Shortcroft Street/ City Road East (Residential)	10/2	7/0	9/0
C: Premier Inn, Medlock Street (Commercial/ Residential)	9/4	5/0	3/-2
D: No. 5 First Street, Medlock Road (Office)	1/-2	-1/-4	-1/-3

Table 9: Calculated excess over threshold noise values for potential significant effect, no mitigation

The expected maximum noise levels during the demolition works at the closest receptor to the Site are up to 10 dB(A) greater than the threshold noise values for potential significant effect due to construction, if no mitigation measures are in place. This noise level is only expected to prevail for relatively short periods of time during the 6 month demolition programme when demolition works are taking place at the Site perimeters closest to each particular receptor. When demolition activities are taking place at a more typical distance from each receptor, the expected maximum noise levels are 2 dB(A) to 4dB(A) greater than the threshold noise values for potential significant effect due to construction if no mitigation measures are in place.

The expected maximum noise levels during the construction works at the closest receptor to the Site are up to 9 dB(A) greater than the threshold noise values for potential significant effect due to construction, if no mitigation measures are in place. This noise level is only expected to prevail for relatively short periods of time when construction works are taking place at the Site perimeter closest to the City South residential building and at a similar height to City South. When construction activities are taking place at a more typical distance from each receptor, the expected maximum noise levels are 2dB greater than the threshold noise values for potential significant effect due to construction if no mitigation measures are in place.

There is therefore the potential for short-term Minor to Moderate Adverse impact due to demolition noise at the existing properties around the Site. During the construction of the proposed development, there is the potential for short-term Negligible to Moderate Adverse impact at the existing noise sensitive receptors. As a consequence, measures to mitigate construction noise would be appropriate.

Demolition and Construction Vibration

As discussed in section B.3.1 of BS5228-2: 2014 'Code of Practice for noise and vibration control on construction and open sites', it is fully expected that the construction vibration levels would not be sufficient to cause structural damage to buildings around the Site.

Natural mitigation of potential ground borne vibration due to the proposed demolition activities will be afforded to the residential buildings around the Site by virtue of the distance of these receptors from the works, as the majority of the existing office building on the Site is more than forty metres from the closest residential building.

Typically the activity which generates the greatest levels of vibration during construction would is piling. Where ground conditions allow, it is understood that continuous flight auger (CFA) piling rigs or rotary bored piling rigs are to be employed. With regard to CFA, Section F.3.2.4 of BS5228-2: 2009 states:

- The levels of vibration associated with continuous flight auger injected piling and pressed-in piling are minimal, as the processes do not involve rapid acceleration or deceleration of tools in contact with the ground but rely to a large extent on steady motions.

With regard to mitigation of vibration from piling operations, section 8.5.3.1 of BS522-2:2009 'Vibration mitigation; Use of alternative methods' states:

- Piling and ground engineering processes are primarily selected on the basis of the ground conditions to be encountered, the loads to be supported and the economics of the system. Taking these constraints into account, the process should be selected that is least likely to give rise to unacceptable vibrations in particular circumstances. Examples would include the use of continuous flight auger injected piles, pressed-in preformed piles, auger bored piles, or possibly impact bored piles in preference to driven piles.

Given rotary bored piling or CFA piling, the impact of vibration is expected to be negligible.

Potential significant effects are not expected to arise on the basis that good communication is established between the Contractor and residents, as detailed further in the Construction Environmental Management Plan submitted as part of the planning application for the proposed development.

The impact of construction vibration on existing sensitive receptors is therefore expected to be Negligible.

Mitigation Measures

The construction of a solid, timber hoarding (2.4 metres high) around the majority of the Site is proposed. This hoarding can be expected to reduce noise levels at local receptors by 0dB(A) to 5dB(A), depending upon the location of the noise source on Site and the height of the receptor.

In addition, the following recommendations must be followed to achieve appropriate reductions of construction noise.

- Noisy plant should be located so as to maximise the distances between the plant and the sensitive receptors.
- The works should be carried out in as timely a manner as possible in order to minimise the duration of any disturbance.
- Via communication between the Contractor and the Council, local residents should be kept informed of general construction activities, including working hours.
- Wherever possible, working hours should be restricted in line with Manchester City Council's typical requirements.
- Excavations in hard materials should use silenced and sensitively located compressors in conjunction with shrouded breakers.
- The drop height of materials into wagons shall be minimised.
- Any materials hoists used on the Site should be enclosed by hoarding at ground level and operated by mains electricity or via a silenced generator.
- Rubbish skips should be housed within enclosed areas that encompass the chute terminations. The materials unloading point should be enclosed.
- All reasonable steps should be taken to limit the number of vehicles waiting to deliver to the Site.
- All plant and equipment should be properly maintained.

- All plant and equipment should be operated in their minimum-noise modes with any manufacturer's silencers and covers properly in place.
- With the exception of enhanced generators, pumps and electric plant, all plant and equipment should be shut down when not in use.
- Vehicle movements should be arranged so as to minimise noise from reversing warning indicators.
- The Contractor should generally comply with the guidance and procedures given in BS5228: 2014.

Given the implementation of the above best practice measures, the impact of construction noise and vibration is expected to be negligible.

8.0 NOISE EGRESS FROM COMMERCIAL UNIT

The commercial unit within the proposed development may potentially be home to a small restaurant or café. Although the unit has an approximate floor area of only 56m2, potential music noise egress from the unit must be assessed.

As detailed in Section 5.0 above, Manchester City Council suggests that external music noise levels (measured as an L_{eq} noise level) external to a residential property due to an entertainment venue should be 10dB lower than the prevailing background noise level in each octave band.

Table 10 identifies the maximum allowable cumulative daytime and night time free-field noise levels at the closest residential façades due to music noise from the proposed commercial unit at One City Road to comply with the guidance of Manchester City Council, , taking into account the threshold of human hearing at low frequency.

Location/period	Sound Pressure Level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
The Nile (0700 to 2300)	43	43	41	41	43	36	23
The Nile (2300 to 0700)	43	35	32	31	32	24	12
City South (0700 to 2300)	49	43	40	40	44	37	26
City South (2300 to 0700)	43	41	34	33	35	30	25

Table 10: Maximum allowable external music noise levels due to commercial units at One, City Road

At this stage, operational noise levels for the proposed commercial unit are not known. However, guidance can be given based on the potential acoustic performance of façade elements. The façades of the proposed commercial unit are to be fully glazed. The principal determinant of noise egress from the development will therefore be the sound reduction index of the installed glazing.

Given the size of the glazing units to the commercial unit, the glazed shop fronts to the commercial units are expected to comprise as a minimum the following double glazed units:

- 10 mm float glass/ 16 mm cavity/ 8.8 mm acoustic laminate, sound reduction index 40dB Rw

Environmental noise egress calculations have been carried out in order to determine the expected external noise levels due to internal noise within the commercial unit. The calculations have initially assumed that the outer entrance door to the commercial unit is closed or that a door lobby is installed, such that during access and egress of patrons, one of the doors of the lobby is closed to prevent intermittent increases in external noise.

Table 11 identifies the noise levels that could be generated in the commercial unit without exceeding the daytime external noise limits given in Table 10.

Location	Spatially averaged sound pressure level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Commercial Unit	86	91	93	95	95	92	81

Table 11: Maximum allowable daytime internal noise levels within the commercial unit, doors closed

Table 12 identifies the noise levels that could be generated in the commercial unit without exceeding the night time external noise limits given in Table 10.

Location	Spatially averaged sound pressure level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Commercial Unit	86	83	84	86	88	80	70

Table 12: Maximum allowable night time internal noise levels within the commercial unit, doors closed

The noise levels detailed in Table 11 and Table 12 would allow typical retail outlets or a 'lively' restaurant with background music replay to be accommodated.

If the external door to the commercial unit is opened without the benefit of an internal lobby, then the sound insulation of the facade will be reduced. Therefore, the maximum allowable noise levels in the unit would be reduced.

Table 13 identifies the noise levels that could be generated in the commercial unit without exceeding the daytime external noise limits given in Table 10, if the entrance door to the unit is open.

Location	Spatially averaged sound pressure level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Commercial Unit	75	75	73	73	75	68	55

Table 13: Maximum allowable daytime internal noise levels within the commercial unit, doors open

Table 14 identifies the noise levels that could be generated in the commercial unit without exceeding the night time external noise limits given in Table 10, if the entrance door to the unit is open.

Location	Spatially averaged sound pressure level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Commercial Unit	75	67	64	63	64	56	44

Table 14: Maximum allowable night time internal noise levels within the commercial unit, doors open

The noise levels detailed in Table 13 and Table 14 would allow a typical retail outlet or relatively quiet restaurant with low-level background music replay to be accommodated.

However, a lively restaurant with music is likely to exceed the allowable internal noise levels given in Table 13 and Table 14, particularly at night time. It is therefore expected that a lively restaurant or similar operation whose opening hours extend beyond 11pm could need to introduce a door lobby in order to comply with the requirements of Manchester City Council.

Given the above, it is expected that the proposed commercial unit within the development will be able to operate within the proposed Planning Class without causing disturbance to existing residential receptors.

It is recommended that the noise levels in Table 11 to Table 14 be written into the agreement-to-lease documents for the commercial units. It is also recommended that the proposals for acoustic treatment and the noise levels to be generated within the commercial unit be formally submitted by any potential tenant by way of an application to discharge relevant conditions that may be attached to the planning permission.

9.0 EXTERNAL NOISE LEVELS DUE TO BUILDING SERVICES

The measured background noise levels around the site can be used to establish the acceptable level of noise from plant serving the development. Final plant selections have not been made at this early design stage. In the absence of specific selection of plant items, overall plant noise limits can be provided.

Non-emergency plant

With reference to the discussion in Section 5, it is recommended that the cumulative rating level due to all simultaneously operating non-emergency plant is at least 5dB lower than the typical pre-existing background noise level at the nearest residential receptors to the site.

Table 15 identifies the allowable combined noise level at the nearest residential receptors to the development, due to all simultaneously-operating non-emergency building services plant and equipment.

Location	Rating noise level (dB L_{Aeq})	
	Daytime (07:00 hrs to 23:00 hrs)	**Night time (23:00 hrs to 07:00 hrs)**
A: The Nile, City Road East (Residential)	50	40
B: City South, Shortcroft Street/ City Road East (Residential)	51	43
C: Premier Inn, Medlock Street (Commercial/ Residential)	56	52
D: No. 5 First Street, Medlock Road (Office)	55	-

Table 15: Environmental noise limits for non-emergency building services plant

Emergency plant

Any emergency plant at the development is expected to only operate during emergencies and during periodical test runs (perhaps test runs of thirty minutes every two weeks). On this basis, it is not considered appropriate to require emergency plant to comply with the noise limits for continuously operating non-emergency plant. It is therefore suggested that the noise level from any emergency plant is no more than 10dB(A) greater than the ambient noise level (measured as an L_{Aeq}) at any residential receptor.

It is therefore recommended that the noise level at any residential façade during operation of any emergency plant does not exceed the daytime noise levels given in Table 16.

Location	Daytime noise level (dB L_{Aeq})
A: The Nile, City Road East (Residential)	75
B: City South, Shortcroft Street/ City Road East (Residential)	68
C: Premier Inn, Medlock Street (Commercial/ Residential)	75
D: No. 5 First Street, Medlock Road (Office)	77

Table 16: Environmental noise limits for emergency building services plant

The above noise limits for non-emergency and emergency plant must be forwarded to the project's Mechanical Engineer to allow the selection of appropriate equipment and any associated noise control hardware. Building services equipment must also be provided with appropriate vibration isolation to minimise the risk of disturbance to the building occupants by structureborne noise.

Service Vehicles

The proposed building includes two small service bays, accessed off Shortcroft Street and City Road East. The bays are to facilitate deliveries and waste collections. The number of delivery or collection events per day will be small and as such the contribution to the ambient daytime average (LAeq,16 hr) noise level is expected to be negligible.

APPENDIX A

NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Medlock Street & City Road, Manchester.

DATES AND TIMES

Tues 17 Mar 2015	16:00 to 20:10
Wed 18 Mar 2015	00:40 to 02:50

Weather during surveys

Tues 17 Mar 2015	7/8 cloud cover, 1 m/s wind, no rain, 7 ^{o}C
Wed 18 Mar 2015	1/8 cloud cover, 1 m/s wind, no rain, 2 ^{o}C

Personnel present during surveys

Matt Fisher – Fisher Acoustics

Instrumentation

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meters (x 2) (serial nos. 28957, 31498)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrators (x2) (serial nos. 31041, 31971)

Measurement methodology

Before and after the noise surveys the sound level metres were check calibrated to an accuracy of ±0.3dB using the Norsonic Type 1251 Calibrators - no drift in sensitivity was detected. The sound level meters were set at a height of 1.5 metres on a tripod. All survey measurements were in free field conditions.

Tables A1 to A4 detail the results obtained from the noise surveys. Measurement locations are shown on Figure 2.

Measurement Position	Start Time	Measured Noise Levels, dB				Noise sources
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
1	16:01	69.9	76.6	73.0	61.0	Road traffic
1	16:06	69.4	74.5	72.2	61.8	“
1	16:11	70.0	76.3	72.7	63.7	“
1	16:16	69.6	76.0	73.3	60.7	“
1	16:21	70.3	81.1	73.5	63.8	“
1	16:26	70.6	82.6	73.3	62.8	“
1	16:31	69.5	80.0	72.8	63.2	“
1	16:36	67.3	74.7	71.0	59.9	“
1	16:41	68.3	81.1	71.5	60.7	“
1	16:46	70.0	76.0	72.8	64.8	“
1	16:51	70.7	78.7	73.5	64.6	“
1	16:56	70.8	82.6	73.7	63.7	“
1	17:01	69.0	75.1	72.0	62.8	“
1	17:06	70.2	75.8	72.9	64.6	“
1	17:11	69.4	78.6	71.6	64.0	“
1	17:16	68.8	74.8	71.5	63.4	“
1	17:21	68.4	75.0	70.7	63.2	“
1	17:26	68.5	75.0	71.5	62.2	“
1	17:31	69.2	74.9	72.4	61.1	“
1	17:36	70.6	79.4	73.6	64.2	“
1	17:41	70.4	77.6	73.6	62.7	“
2	16:00	68.1	76.0	70.9	62.4	“
2	16:05	66.9	74.8	69.8	61.3	“
2	16:10	66.5	71.7	69.1	59.7	“
2	16:15	67.1	73.7	69.6	62.0	“
2	16:20	66.6	73.5	70.1	59.5	“
2	16:25	67.5	77.3	70.4	61.4	“
2	16:30	68.1	78.2	70.6	61.6	“
2	16:35	66.6	73.8	69.2	61.1	“
2	16:40	64.1	73.5	66.9	58.8	“
2	16:45	65.7	72.1	68.4	59.9	“
2	16:50	67.4	75.5	69.9	62.2	“
2	16:55	67.9	74.7	70.7	63.1	“
2	17:00	67.7	77.2	70.3	62.4	“
2	17:05	65.8	71.5	68.6	60.7	“
2	17:10	67.3	72.3	69.7	62.9	“
3	17:15	62.1	78.8	63.6	58.0	“
3	17:20	60.9	70.4	62.5	58.8	“
3	17:25	60.2	64.2	62.0	56.5	“
3	17:30	61.0	71.2	62.9	57.9	“
3	17:35	61.1	65.7	63.3	57.6	“
3	17:40	62.6	72.6	64.3	58.3	“
3	17:45	62.1	66.6	64.2	58.1	“
3	17:50	62.9	71.1	64.9	59.8	“
4	17:56	58.2	68.9	59.8	55.9	“
4	18:01	57.4	63.1	59	55.5	“
5	18:08	65.2	73.7	67.3	62.2	Road traffic, extract fan at Premier Inn
5	18:13	65.9	76.3	68.3	62.1	“
6	18:20	65.3	78.3	67.8	55.9	Road traffic
6	18:25	65.8	80.4	67.9	58.6	“
7	18.33	53.0	68.6	54.9	49.7	“
7	18:38	53.0	61.0	55.0	49.5	“
8	18:46	59.4	68.1	61.7	55.0	Road traffic, train
8	18:51	61.3	80.7	62.9	56.1	“
4	18:58	56.9	80.7	58.2	55.4	Road traffic
4	19:03	57.5	65.6	58.8	55.6	“

Measurement Position	Start Time	Measured Noise Levels, dB				Noise sources
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
5	19:10	64.4	74.1	66.1	61.6	Road traffic, extract fan at Premier Inn
5	19:15	63.8	69.2	65.6	61.3	"
9	19:20	57.7	61.7	59.1	55.8	Road traffic
9	19:25	58.1	62.2	59.5	56.2	"
6	19:32	63.4	78.4	65.9	56.1	"
6	19:37	62.8	80.1	64.9	55.1	"
7	19:45	51.5	59.5	54.3	48.5	"
7	19:50	53.1	60.6	55.6	49.3	"
8	19:58	59.3	69.6	61.8	53.6	Road traffic, train
8	20:03	58.8	70.2	61.5	53.2	"

Table A1: Summary Statistical Noise Levels – Daytime 17th March 2015

Measurement Position	Start Time	Noise Level, dB L_{Aeq}	Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
			63	125	250	500	1k	2k	4k
1	16:01	69.9	72.9	67.8	65.4	62.9	67.3	63	51.4
1	16:06	69.4	71.7	65.2	64.4	62.6	66.8	62.5	51.9
1	16:11	70.0	71.6	64.4	64.3	62.6	67.7	62.9	50.4
1	16:16	69.6	70.4	64.9	64.5	62.8	67.3	62.3	50.3
1	16:21	70.3	71.6	69.2	67.8	63.8	67.6	63.2	51.7
1	16:26	70.6	71.1	71.3	66.7	64.3	67.9	63.4	51.4
1	16:31	69.5	70.9	66.2	64.7	62.9	67.1	62.4	50.6
1	16:36	67.3	71.2	64.1	63.4	60.5	64.8	60.0	48.5
1	16:41	68.3	70.6	64.6	65.4	61.9	65.5	60.8	53.0
1	16:46	70.0	70.5	65.4	65.0	63.1	67.5	63.2	51.8
1	16:51	70.7	71.1	70.4	66.6	63.7	68.0	63.7	51.9
1	16:56	70.8	70.7	69.3	66.2	64.2	68.1	63.8	52.3
1	17:01	69.0	70.7	64.6	64.0	61.8	66.5	62.1	50.2
1	17:06	70.2	69.6	65.4	64.8	63.2	67.7	63.4	51.3
1	17:11	69.4	73.5	65.9	65.7	62.2	66.7	62.6	50.9
1	17:16	68.8	70.3	64.8	64.2	61.9	66.3	61.7	49.6
1	17:21	68.4	70.6	65.6	64.4	61.5	65.9	61.2	49.2
1	17:26	68.5	70.7	64.8	64.7	61.7	66..0	61.3	49.1
1	17:31	69.2	70.3	63.9	64.1	62.2	66.9	62.0	49.4
1	17:36	70.6	72.0	69.9	66.4	64.2	67.8	63.7	51.5
1	17:41	70.4	70.1	63.8	64.4	62.8	68.0	63.6	51.1
2	16:00	68.1	72.4	65.6	64.3	63.5	65.0	60.8	51.4
2	16:05	66.9	72.1	67.4	64.5	61.5	63.6	59.9	49.9
2	16:10	66.5	70.9	64.1	63.1	61.0	63.3	59.7	49.5
2	16:15	67.1	71.2	63.7	63.4	61.3	64.2	60.0	48.7
2	16:20	66.6	70.6	64.6	63.6	61.1	63.6	59.3	48.6
2	16:25	67.5	70.6	68.0	66.2	62.4	64.1	60.2	49.5
2	16:30	68.1	70.3	69.6	65.3	62.8	64.8	60.8	50.1
2	16:35	66.6	70.9	65.5	64.1	61.3	63.4	59.3	48.7
2	16:40	64.1	70.7	64.3	63.4	59.0	60.5	56.4	47.1
2	16:45	65.7	70.3	63.8	63.2	60.1	62.5	58.5	50.1
2	16:50	67.4	70.0	68.8	65.4	61.9	64.1	60.4	50.1
2	16:55	67.9	69.9	65.8	64.3	62.2	64.8	61.2	50.3
2	17:00	67.7	70.6	67.9	64.6	62.5	64.5	60.6	50.4
2	17:05	65.8	69.9	64.0	62.9	60.2	62.7	58.8	47.8
2	17:10	67.3	69.9	64.9	63.7	61.8	64.2	60.6	49.6
3	17:15	62.1	70.8	63.9	63.9	58.7	57.3	53.4	43.5
3	17:20	60.9	68.7	63.0	61.3	57.2	56.9	52.6	42.8
3	17:25	60.2	66.8	63.6	60.3	55.4	56.5	52.0	41.4
3	17:30	61.0	68.5	62.5	62.0	57.0	56.9	52.8	44.1
3	17:35	61.1	68.2	62.4	61.5	56.9	57.4	53.0	41.6
3	17:40	62.6	69.7	66.9	63.5	59.1	57.9	54.3	43.3
3	17:45	62.1	68.4	62.0	61.6	57.1	58.6	54.8	43.1
3	17:50	62.9	69.1	64.5	62.8	58.1	59.1	55.5	46.0
4	17:56	58.2	66.2	59.6	56.5	53.5	55.4	49.2	39.5
4	18:01	57.4	66.7	60.8	55.9	52.1	54.5	48.4	39.3
5	18:08	65.2	69.5	62.2	60.0	59.8	62.8	57.1	47.9
5	18:13	65.9	68.9	62.3	61.2	61.3	63.3	57.6	48.0

Measurement Position	Start Time	Noise Level, dB L_{Aeq}	Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
			63	125	250	500	1k	2k	4k
6	18:20	65.3	68.5	61.7	60.8	60.4	62.8	56.8	49.6
6	18:25	65.8	67.3	63.2	62.1	61.6	63.0	57.3	49.5
7	18.33	53.0	61.0	51.8	48.4	48.3	50.6	44.1	35.5
7	18:38	53.0	64.2	57.4	48.7	48.0	50.4	43.5	35.4
8	18:46	59.4	65.7	57.6	55.9	53.9	56.8	51.2	40.4
8	18:51	61.3	68.4	61.6	60.6	58.8	57.6	52.2	42.8
4	18:58	56.9	64.8	57.5	54.9	50.3	54.6	48.2	37.1
4	19:03	57.5	64.9	58.4	57.3	51.6	54.6	48.7	39.3
5	19:10	64.4	68.9	61.6	59.7	59.6	61.8	56.0	47.9
5	19:15	63.8	69.4	62.3	59.0	58.1	61.5	55.5	46.8
9	19:20	57.7	63.4	55.6	52.4	52.0	55.8	48.7	37.3
9	19:25	58.1	61.8	56.0	51.4	52.0	56.3	49.1	37.1
6	19:32	63.4	65.0	59.1	58.7	57.4	61.2	55.2	43.8
6	19:37	62.8	66.8	60.4	58.7	57.4	60.7	53.5	43.1
7	19:45	51.5	59.3	51.5	47.1	46.4	49.4	42.1	31.1
7	19:50	53.1	62.4	53.6	49.9	49.0	50.4	44.0	32.6
8	19:58	59.3	68.0	58.2	56.0	53.9	56.6	51.3	40.1
8	20:03	58.8	64.6	57.5	56.0	53.7	56.2	50.7	40.6

Table A2: Measured Octave Band L_{eq} Noise Levels – Daytime 17th March 2015

Measurement Position	Start Time	Measured Noise Levels, dB				Noise sources
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
4	00:40	50.2	55.7	52.9	47.1	Road traffic
4	00:45	51.0	64.4	53.6	45.9	"
5	00:51	61.4	70.9	64.3	58.2	"
5	00:56	62.8	69.7	66.3	59.2	"
9	01:01	53.5	62.1	56.0	49.5	"
6	01:07	55.5	73.4	55.8	45.8	"
6	01:12	60.6	79.3	58.3	45.9	"
8	01:20	49.7	58.3	52.5	45.4	"
8	01:25	54.5	72.1	57.6	46.8	"
7	01:33	45.7	54.9	48.1	42.9	"
7	01:38	45.5	55.3	48.2	43.1	"
4	01:45	52.3	61.5	55.0	47.6	"
4	01:50	50.1	59.3	52.3	47.2	"
5	01:56	59.6	67.1	62.7	56.5	"
9	02:01	52.2	58.7	54.9	48.3	"
9	02:06	53.2	63.7	55.5	48.5	"
6	02:13	51.6	62.1	55.6	44.9	"
6	02:18	51.9	63.6	56.2	44.9	"
7	02:26	48.9	61.6	50.9	44.4	"
7	02:31	45.8	51.5	48.8	42.7	"
8	02:39	53.5	68.9	58.6	43.5	"
8	02:44	54.1	71.9	56.3	47.8	"

Table A3: Summary Statistical Noise Levels – Night time, 18th March 2015

Measurement Position	Start Time	Noise Level, dB L_{Aeq}	Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
			63	125	250	500	1k	2k	4k
4	00:40	50.2	57.6	52.3	48.3	43.8	47.6	41.9	30.2
4	00:45	51.0	62.2	57.1	49.6	45.3	47.6	42.7	32.4
5	00:51	61.4	62.5	62.3	57.7	57.2	58.1	53.8	46.8
5	00:56	62.8	66.3	62.7	58.0	58.6	59.5	55.2	48.1
9	01:01	53.5	58.2	53.1	47.8	47.7	51.2	45.0	37.2
6	01:07	55.5	58.6	52.5	51.6	50	53.2	46.9	36.2
6	01:12	60.6	63.4	56.8	55.2	54.9	58.3	52.6	43.3
8	01:20	49.7	58.0	51.3	45.9	44.3	47.4	40.6	28.7
8	01:25	54.5	62.0	55.4	50.2	48.0	51.6	46.7	41.1
7	01:33	45.7	56.1	47.8	42.4	41.5	42.8	36.6	27.4
7	01:38	45.5	56.3	49.9	42.7	41.6	42.0	36.7	29.1
4	01:45	52.3	59.4	55.8	50.4	48.3	49.4	43.2	32.2
4	01:50	50.1	58.8	54.9	49.1	45.3	47.2	40.7	30.6
5	01:56	59.6	62.1	62.2	54.2	54.9	56.1	52.1	46.4
9	02:01	52.2	54.8	52.4	46.3	46.3	49.8	44.1	35.8
9	02:06	53.2	61.1	53.8	47.8	47.3	50.7	45.3	36.6
6	02:13	51.6	56.2	47.3	45.6	45.5	49.4	43.8	29.9
6	02:18	51.9	61.0	50.8	48.5	47.8	49.2	42.7	33.0
7	02:26	48.9	56.7	50.0	47.1	44.4	45.7	39.5	36.4
7	02:31	45.8	54.8	48.0	45.0	42.5	42.5	36.1	26.8
8	02:39	53.5	63.0	56.1	53.6	51.4	49.0	43.7	37.3
8	02:44	54.1	63.2	56.3	52.8	49.8	50.4	45.7	41.3

Table A4: Measured Octave Band L_{eq} Noise Levels – Night time, 18th March 2015

APPENDIX B

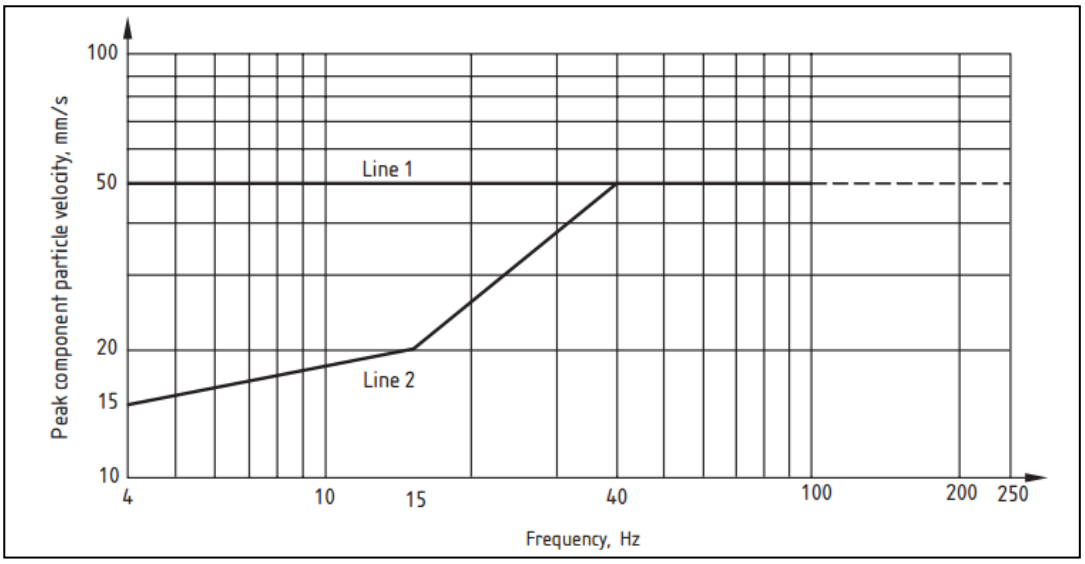


Figure B1: Transient vibration guide values for cosmetic damage