MIAMI LTD

NOISE ASSESSMENT

NEW BIRD STREET, LIVERPOOL

8 March 2017

AEC REPORT: P3276/R1A/PJK

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1.0 INTRODUCTION

1.1 Acoustic & Engineering Consultants Limited (AEC) has been appointed by Iliad Group on behalf of Miami Ltd to assess the noise levels affecting the proposed residential blocks on land off New Bird Street, Liverpool. This noise assessment is required to accompany the associated planning application for the development.

1.2 This report details the ambient and maximum noise levels measured on site, presents the assessment criteria and discusses the implications on the building design to achieve acceptable internal noise levels to meet appropriate requirements.

1.3 Acoustic terminology used throughout the report is described in brief in Appendix A.

2.0 BACKGROUND AND SITE DESCRIPTION

2.1 A scheme to redevelop land on New Bird Street, Liverpool has been prepared by Tim Groom Architects. The scheme includes numerous ground floor commercial units with four accommodation blocks in a square shape above, as presented on Figure 1. There will be an open courtyard in the middle of the development, which is a shared communal area.

2.2 The proposed development site is located within an area of Liverpool known as the Baltic Triangle and is currently used as commercial unit.

2.3 The site is bound to the east by St James Street, which is a relatively busy road into Liverpool City Centre. Opposite the site is a light shop and commercial unit who provide screenprinting products to the print and sign industry.

2.4 To the north are industrial/commercial units on Jordan Street. During the measurement period it was noted that there was no external works or building services plant associated with these units. Beyond the units on Jordan Street, there were construction works.

2.5 Opposite Newhall Street, to the west, is a car park and more industrial/commercial units.

2.6 To the south of the site, on New Bird Street, is Lee Floorstok Ltd, a distributor of flooring materials and the proposed development will overlook the service yard of the unit. During the measurement period it was noted that the high backed vans arrive on site and are loaded with rolls of flooring. The loading is undertaken both manually and with an electric forklift truck. Based on conversations with a member of staff it is understood that typical activities were occurring during the daytime measurements.

2.7 To the east of Lee Floorstok is a row of four disused units.

2.8 It was noted that, with the exception of Lee Floorstok Ltd, there were no external works associated with any of the units close to the development and all of the industrial/commercial units were closed at night.

2.9 Beyond Lee Floorstock to the south is the Constellations and Observatory which is an event venue with an external garden area and an internal event space. It is understood that music events can take place in the garden area during the summer months.

2.10 To the southwest of the site is Hanger 34 which is an event space, which operates on a Friday and Saturday night. The venue is not open every weekend, however, Hanger 34 is licensed to operate up to 0400h. On the weekend of the site measurements Hanger 34 was open from 2100 until 0400h.

3.0 NOISE CLIMATE

3.1 Daytime noise levels were measured by AEC on Monday 25 July 2016 between 1300 and 1600h and night-time noise levels were measured on between 2300 and 0100h on Monday 25 and Tuesday 26 July 2016. Weekend noise levels were measured by AEC on Sunday 5 March 2017 between 0300 and 0430h, when both Hanger 34 and Constellations and Observatory where having events.

3.2 Full details of the noise surveys are presented in Appendix B with measured noise data presented in Tables B1, B2 and B3.

Weekday Measurements

3.3 Noise levels were measured at four locations around the site, identified as A to E on Figure 1. The noise levels measured at Locations B and D were taken under façade conditions, and a -3dB correction has been applied to these measured noise levels to represent free-field noise levels.

3.4 Location A was selected to measure the noise level from road traffic on St James Street at location representative of the eastern elevation of the proposed development. During the daytime period the road traffic was relatively constant, with measured noise levels around 65dBL_{Aeq} and 70dBL_{A10}.

3.5 At night the ambient noise level ranged from 54 to 57dB$L_{Aeq,\ T}$ and maximum noise levels were no greater than 74dBL_{Amax}.

3.6 Location B was selected to represent the apartment blocks which will overlook Jordan Street. The daytime ambient noise level at this location was a combination of road traffic on Jordan Street, St James Street and construction noise. The daytime ambient noise level was consistently around 56dBL_{Aeq}.

3.7 The night-time noise level at this location was mainly due to road traffic on St James Street. The ambient noise level was consistently around 48dB$L_{Aeq,T}$ and maximum noise levels were no greater than 64dBL_{Amax} as a result of a car pass by.

3.8 Daytime ambient and night-time ambient and maximum noise levels were measured opposite the car park on Newhall Street, Location C. During the daytime the ambient noise level ranged from 55 to 57dBL_{Aeq} depending on the number of car pass-bys on the surrounding roads.

3.9 At night, the ambient noise level ranged from 42 to 46dB$L_{Aeq,T}$ due to distant road traffic, with maximum noise levels no greater than 57dBL_{Amax}.

3.10 The ambient noise level at Location D was consistently around 55dB$L_{Aeq,T}$ due to a combination of road traffic noise on the surrounding roads and activity noise on the Lee Floorstok Ltd site. The night-time ambient noise level at this location ranged from 44 to 49dB$L_{Aeq,T}$ depending on the number of vehicles on New Bird Street. Maximum noise levels at this locations did not exceed 68dBL_{Amax}.

3.11 Following the development of the scheme, the apartments within the scheme themselves will be the nearest noise sensitive properties to the ground floor commercial units The day and night-time background noise levels presented in Table 1, below, are representative of these apartments.

Table 1 – Typical Weekday Background Noise Levels at Nearest Noise Sensitive Properties

Location	Noise Level, dBL_{A90}	
	Day	Night
St James Street (A)	52	41
Jordan Street (B)	46	35
Newhall Street (C)	49	39
New Bird Street (D)	45	37

Weekend Measurements

3.12 As agreed with Ian Rushforth, an Environmental Health Officer at Liverpool City Council (LCC), noise levels were measured between approximately 0300 and 0400h on the proposed development site, on Sunday 5 March 2017. Noise levels were measured on this date as events were occurring in both Hanger 34 and Constellations and Observatory.

3.13 The main noise monitoring location, identified as location E on Figure 1, was selected as this was deemed to be representative of the façade of the proposed building nearest to Hanger 34. Ambient noise levels at this location ranged from 60 to 62dB$L_{Aeq, 5min}$ during the first part of the measurement period. It is assumed that this is the typical noise level during the main hours of operation.

3.14 Maximum noise levels during this period were no greater than 69dBL_{Amax} due to amplified music noise breaking out of the night-club.

3.15 Around 0345h, subjectively the noise breaking out of Hanger 34 appeared to reduce and the measured ambient noise level at this time was around 55dB$L_{Aeq, 3min}$. Maximum noise levels were also lower at 65dBL_{Amax}.

3.16 At 0400h Hanger 34 closed and the ambient noise level due to patrons leaving was around 57dB$L_{Aeq, 8min}$ with a maximum noise level due to a person shouting of 77dBL_{Amax}.

3.17 Spot check measurements were also undertaken on Jordan Street. During the loudest period of operation the ambient noise level at this location, due to noise breaking out of Hanger 34 only, was 54dB$L_{Aeq, 1min}$. This dropped to 52dB$L_{Aeq, 1min}$ when the noise levels were subjectively quieter.

3.18 Maximum noise levels at this location were consistently around 58dBL_{Amax} during both the louder and quieter periods.

3.19 A spot check measurement was also undertaken adjacent to the entrance of Constellations and Observatory on Greenland Street. The ambient and maximum noise levels due to noise breaking out of this venue were 63dB$L_{Aeq, 1min}$ and 68dBL_{Amax}.

4.0 BASIS OF ASSESSMENT

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. This document provides little mention of planning polices with regard to noise with the exception of paragraph 123 that states:

'Planning policies and decisions should aim to:

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

4.2 The terms '*significant adverse'* and '*adverse*' above are referenced to the Noise Policy Statement for England (NPSE), published by Department for Environment, Food and Rural Affairs (DEFRA) dated March 2010. One of the main aims of this policy is also to avoid significant adverse effects on health and quality of life.

4.3 With respect to the two terms above, the explanatory note for the NSPE introduces two concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation (WHO). They are:

- "*NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*
- *LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.*

  Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.
- *SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur*."

4.4 National Planning Practice Guidance, an online resource, brings together the aims of the NPPF and NPSE and tries to indicate how the likely perception and average response to noise relates to the effect levels. This is summarised in Appendix C below.

4.5 Further to the above, the Governments '*Planning Practice Guidance*' dated 6 March 2014 indicates:

'Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.'

4.6 In addition, the guidance indicates that, whilst noise can override other planning concerns, it should not be considered in isolation from the economic, social and other environmental dimensions of any proposed development.

Noise Break-In

4.7 Following a consultation with Ian Rushforth, he confirmed that they generally require that as a minimum the external envelopes of residential accommodation in the city centre incorporate windows with 10mm glass/thermal cavity/6mm glass and for habitable rooms to be provided with acoustically attenuated mechanical ventilation to remove the need to open windows. However, this is based on achieving the noise level limits presented below for different noise sources.

Road Traffic and Industrial Noise Sources

4.8 In relation to internal levels due to the surrounding industrial/commercial units it was agreed with Ian that internal noise levels should be no greater than those presented in BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings' and* World Health Organisation (WHO) document '*Guidelines for Community Noise*'.

4.9 These documents state that to avoid sleep disturbance and conditions for resting, inside dwellings, the noise level should not exceed 30dB$L_{Aeq,\ 8\ hour}$ and 45dBL_{Amax} at night in bedrooms at night and 35dB$L_{Aeq,\ 16\ hour}$ in living rooms during the day.

4.10 Where these internal levels can be achieved with an alternative glazing and ventilation strategy other than the one provided above, the suggested alternative scheme needs to be agreed with LCC.

Noise from Night-Clubs/Event Spaces

4.11 During our discussions with Ian Rushforth it was confirmed that noise from amplified music breaking out of the night-clubs/event spaces in the area should be controlled to no greater than NR30L_{max} in the living rooms during the daytime and NR25L_{max} in the bedrooms at night.

External Noise levels

4.12 In relation to the balconies, BS8233 states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB$L_{Aeq,T}$, with an upper guideline value of 55dB$L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.

In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

4.13 Taking the above into account, and the fact that site is located within the city centre, it is anticipated that there will be no practical mitigation measures to reduce noise levels on the balconies, as such this assessment simply reports the measured external noise levels only.

Noise Egress

4.14 Following discussions with LCC, AEC has been informed that any items of plant should be assessed using BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound*', and the 'rating' level should not exceed the existing background at the nearest noise sensitive residential property.

4.15 Paragraph 9.1 of BS4142 identifies that "*Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment locations, add a character corrections to the specific sound level to obtain the rating level.*"

4.16 The noise levels from ground floor daytime activities would not only need to be controlled externally to no greater than the background at the nearest noise sensitive properties, but there would also be a need to control noise to the apartments above. Controlling noise levels in the apartments above to not exceed NR30L_{max} would be expected to be acceptable.

5.0 ASSESSMENT OF PROPOSED DEVELOPMENT

External Envelope Sound Insulation Requirements

Road Traffic Noise

5.1 Road traffic on St James Street is sufficiently busy to allow the daytime ambient noise level ($dBL_{Aeq, 16h}$) to be calculated on the eastern elevation using the shortened measurement procedure presented in the Calculation of Road Traffic Noise.

5.2 Based on the measured $L_{A10, 3h}$ of 70dB, to convert the $L_{A10, 3h}$ to a daytime average, $L_{A10, 18h}$, 1dB is subtracted. To convert this to an ambient noise level, a further 2dB is subtracted, giving an overall level of 67$dBL_{Aeq, 16h}$. This overall level of 67dBL_{Aeq}, is marginally above the measured short term ambient noise level at this location, and, therefore, this higher level has been used in the assessment.

5.3 It should be noted that in relation to the northern elevation, ambient and maximum noise levels from the nearby event spaces would be significantly below the daytime and night-time ambient and maximum noise levels due to road traffic on St James Street, and, therefore, only road traffic noise has been assessed at this location.

Event Noise

5.4 In regards to the daytime ambient noise levels on the other three elevations which overlook the surrounding roads and industrial/commercial units, the highest measured noise levels have been used in this assessment, and are presented in Table 2, below.

5.5 As stated above, Hanger 34 can operate from 2100h and Constellations and Observatory has planning permission for open air music events during the summer. Therefore, it has been assumed that the maximum noise levels measured during the 'quieter' period of the Hanger 34 operations would be representative of the maximum noise levels during the daytime period (prior to 2300h). These anticipated maximum noise levels are presented in Table 2 below.

5.6 At night, the highest measured ambient and maximum noise levels measured during the weekday and weekend nights are presented in Table 2 below.

5.7 In relation to the elevations which overlook the central courtyard, it is anticipated that external noise levels would be around 20dB lower than those measured around the site, and these levels are also provided in Table 2, below.

Table 2 – Anticipated Noise Levels due to Existing Noise Sources

Elevation	Source	Noise Level, dB			
		Day 0700-2300		Night 2300-0700	
		$L_{Aeq, 16h}$	L_{Amax}	$L_{Aeq, 8h}$	L_{Amax}
St James Street	Road Traffic	67	-	57	74
Jordan Street	Road Traffic	56	-	48	64
	Amplified Music	-	58	54	58
Newhall Street	Road Traffic	57	-	57	77
	Amplified Music	-	65	62	67
New Bird Street	Road Traffic	55	-	57	77
	Amplified Music		65	62	67
Internal Courtyard	Road Traffic	<50	-	<40	<50
	Amplified Music	-	<45	<45	<50

Glazing and Ventilation Requirements

5.8 The WHO document assumes that attenuation of external to internal noise levels provided by a window partially open for ventilation is up to 15dB, which relates to allowable external levels of 55dBL_{Aeq} outside habitable rooms during the daytime, and 45dBL_{Aeq} and 60dBL_{Amax} during the night-time, in order to use partially opened windows for ventilation.

5.9 A comparison between these allowable external noise levels and those presented in Table 2 indicates that the required internal noise levels would only be achieved with windows closed for ventilation purposes, with the exception of those living rooms and bedrooms which overlook the internal courtyard.

5.10 Calculations have been undertaken to determine the required glazing and ventilation to meet the required internal noise levels presented in Section 4 depending on the noise source.

5.11 The calculations have been based on the measured external noise levels, the area of the windows and room dimensions presented on the provided drawings, and the required glazing and ventilation sound insulation specification for each elevation are presented in Table 3, below.

5.12 Example glazing build ups to achieve the required sound insulation performances are also presented in Table 4, below.

5.13 In relation to the ventilation strategy, as stated LCC require that all habitable rooms in properties in the city centre are mechanically ventilated. The calculations indicate that in some areas ventilation could be provided by systems which include openings in the external envelope. This needs to be agreed with LCC.

Table 3 – Outline Requirements to Achieve Internal Noise Levels in Habitable Rooms

Elevation	Room / Period	Sound Insulation Performance	
		Glazing	Ventilation
St James Street (A)	Living Room / Day	$38dBR_w$ / $32dBR_w + C_{tr}$	$36dBD_{n,e,w}$
	Bedroom / Night	$34dBR_w$ / $27dBR_w + C_{tr}$	$36dBD_{n,e,w}$
Jordan Street (B)	Living Room / Day	$38dBR_w$ / $32dBR_w + C_{tr}$	$33dBD_{n,e,w}$
	Bedroom / Night	$42dBR_w$ / $35dBR_w + C_{tr}$	$38dBD_{n,e,w}$
Newhall Street (C)	Living Room / Day	$49dBR_w$ / $43dBR_w + C_{tr}$	MV*
	Bedroom / Night	$54dBR_w$ / $49dBR_w + C_{tr}$	MV*
New Bird Street (D)	Living Room / Day	$49dBR_w$ / $43dBR_w + C_{tr}$	MV*
	Bedroom / Night	$54dBR_w$ / $49dBR_w + C_{tr}$	MV*
Overlooking Internal Courtyard	Living Room / Day	$31dBR_w$ / $25dBR_w + C_{tr}$	$33dBD_{n,e,w}$
	Bedroom / Night	$31dBR_w$ / $25dBR_w + C_{tr}$	$33dBD_{n,e,w}$

*** MV = Mechanical Ventilation**

Table 4 – Example Glazing Build Ups to Achieve the Required Sound Insulation Performances

Glazing Sound Insulation Performance	Example Glazing Build Up
$31dBR_w$ / $25dBR_w + C_{tr}$	4mm thick glass / Thermal Cavity / 4mm thick glass
$34dBR_w$ / $27dBR_w + C_{tr}$	6mm thick glass / Thermal Cavity / 6.4pvb
$38dBR_w$ / $32dBR_w + C_{tr}$	10mm thick glass / Thermal Cavity / 6mm thick glass
$42dBR_w$ / $35dBR_w + C_{tr}$	10mm thick glass / Thermal Cavity / 8.8mm thick glass
$49dBR_w$ / $43dBR_w + C_{tr}$	12.76mm thick LamiGlass SR (PVB) / Thermal Cavity / 10.76mm thick LamiGlass SR (PVB)*1
$54dBR_w$ / $49dBR_w + C_{tr}$	12.76mm thick LamiGlass SR (PVB) / Thermal Cavity / 6mm Float Glass / Thermal Cavity / 10.76mm thick LamiGlass SR (PVB)*1*2

***1 – High Performing Glazing**
***2 – Triple Glazing System**

5.14 The window systems with a sound insulation performance of $49dBR_w$ and $54dBR_w$ are very high performing glazing and the calculation have been based on Guardian Glass systems which have been laboratory tested. Alternative systems can be used, however, manufacturers test certificate would be required.

5.15 Windows can be openable providing that they are effectively acoustically sealed when closed and it is important that any frames and seals do not downgrade the sound insulation performance of the glazing.

5.16 The ventilation systems proposed are based on the provision of one vent into each room, with the exception of the rooms identified as requiring mechanical ventilation, where it is assumed there are no external openings to the rooms.

Other Façade Elements

5.17 With regard to the other façade elements these should be selected in order that the on-site sound insulation performance (dBR'_w) is at least 10dB higher than the performances indicated in Table 3. Therefore, the performance of the external envelope will need to be around $50dBR'_w$ on the St James Street elevation, $55dBR'_w$ on Jordan Street and $65dBR'_w$ on New Bird Street and Newhall Street.

Noise Breakout from Other Building Uses

Noise Breakout from Commercial Units

5.18 Noise breakout from the building in terms of typical, L_{Amax}, levels should be controlled to not exceed the existing background noise levels in the area of about $45dBL_{A90}$ during the day external to the New Bird Street elevation and $35dBL_{A90}$ at night on the Jordan Street elevation.

5.19 It is understood that the retail units would be used for small commercial enterprises and would, therefore, not include music venues. Based on this, it is anticipated that the noise level within the retail units would not be expected to exceed the values stated in Table 5, below.

Table 5 – Anticipated Maximum Noise Levels in Retail Units

Retail Use	Maximum Noise Level, dBL_{max}							
	Overall A-weighted	Octave Band Centre Frequency, Hz						
		63	125	250	500	1k	2k	4k	8k
Typical Maximum Noise Level	Approx 90	80	80	85	85	85	85	80	80

5.20 The weakest element, acoustically, in the external envelope would typically be the glazing. Assuming that any curtain walling to the retail provides a sound insulation of at least $38dBR_w$, then noise breakout would be adequately controlled. Therefore, there would be expected to be no impact due to noise breaking out of the retail units, even if the units were operating at night.

5.21 The noise levels from ground floor activities would not only need to be controlled externally, but there would also be a need to control noise to the adjacent apartments above. The party floor construction between the retail units and the apartments would need to achieve, as a minimum, the sound insulation value required to meet Approved Document E of The Building Regulations, which is $45dBD_{nT,w} + C_{tr}$.

5.22 However, a higher sound insulation performance of around $60dBD_{nT,w} + C_{tr}$ is likely to be required to achieve below $NR30L_{max}$ in the apartment rooms.

5.23 If the floor construction includes a 200mm thick solid concrete slab, and higher noise levels are produced with the units, these levels could be controlled by installing a mass barrier ceiling and/or noise limits could be included in any tenancy agreements.

Plant Noise

5.24 Although it is not yet known what plant is to be associated with this development and where it will be located, control of plant noise at the nearest noise sensitive properties should not be onerous. As identified above, the nearest noise sensitive properties will be the apartments in the development.

5.25 In order to comply with LLCs requirement that the rating noise level does not exceed the background noise level at the nearest properties, a -5dB correction has been applied to the measured background noise levels presented in Table 1. This correction is to allow for any acoustic character associated with the building services plant. Based on the proposed correction, the noise level limit on each elevation is presented in Table 6, below.

Table 6 – Noise Level Limit on each Elevation due to Plant Noise

Location	Noise Level, dBL_{A90}	
	Day	Night
St James Street (A)	47	36
Jordan Street (B)	41	30
Newhall Street (C)	44	34
New Bird Street (D)	40	32

6.0 SUMMARY AND CONCLUSION

6.1 Acoustic and Engineering Consultants Limited has been appointed Iliad Group on behalf of Miami Ltd to undertake a noise assessment of the proposed mixed use development at New Bird Street, Liverpool. The scheme consists of four accommodation blocks in a square shape and ground floor commercial units.

6.2 Following a consultation with Ian Rushforth, an Environmental Health Officer at Liverpool City Council (LCC) it was confirmed that internal levels due to noise from the surrounding roads and industrial/commercial units would need to be controlled to meet the levels presented in BS 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’ and World Health Organisation (WHO) document ‘Guidelines for Community Noise’.

6.3 In relation to noise from the surrounding event venues, including Hanger 34 and Constellations and Observatory, maximum noise levels from amplified music should be controlled to $NR30L_{max}$ in living rooms during the day and NR25Lmax in bedrooms at night.

6.4 Based on the measured noise levels affecting the proposed development site, the sound insulation requirements of the building envelope and ventilation, to achieve the appropriate internal noise levels presented in Section 4 have been determined and are presented in Section 5.

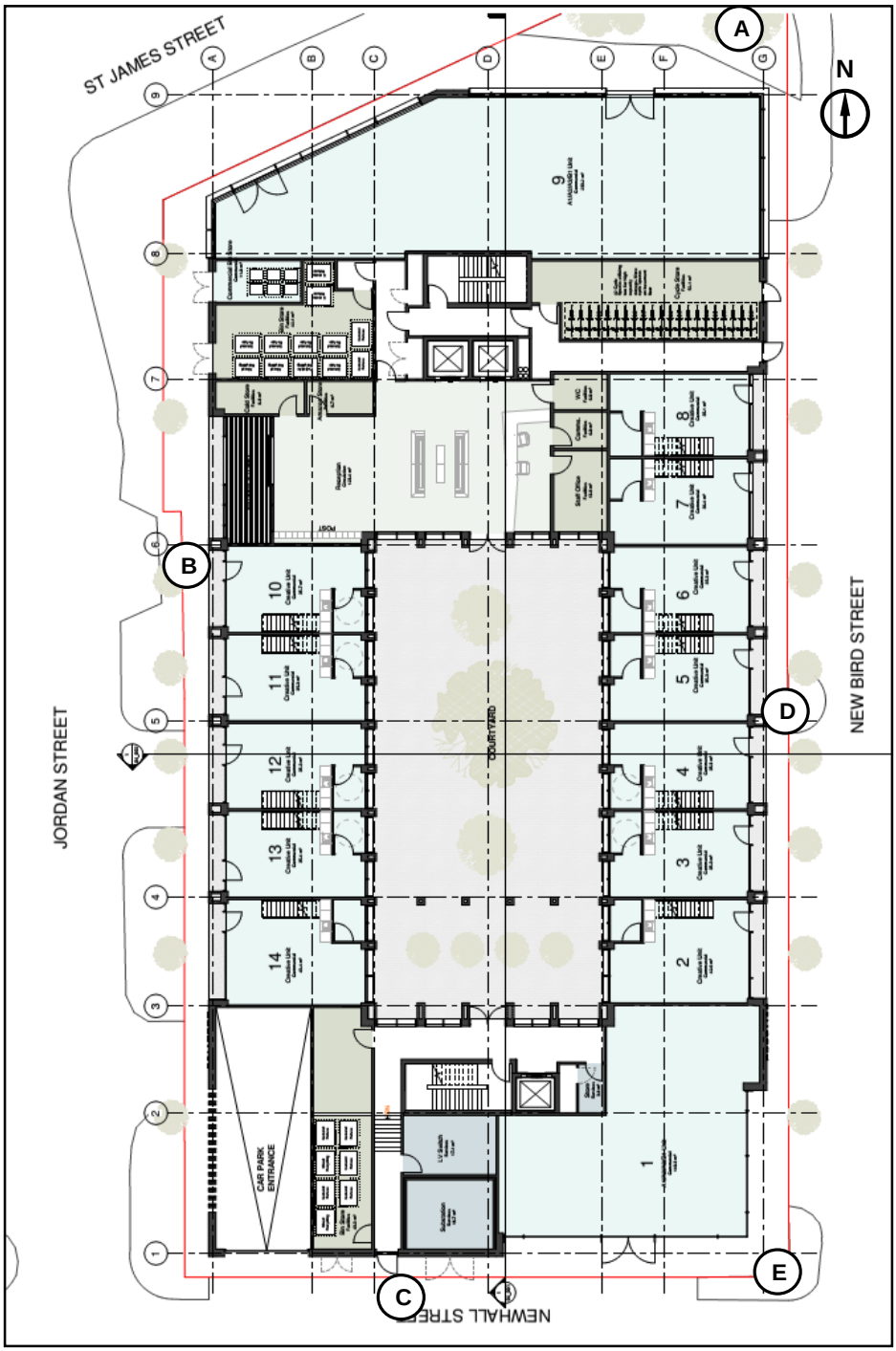
6.5 Measures to control the potential impact of noise break out of the ground floor commercial units on the nearest noise sensitive properties and the first floor apartments are also presented in Section 5.

6.6 Total external noise level limits for all future mechanical and electrical plant serving the proposed development should be controlled to the levels presented in Table 6.

6.7 Based on the above, appropriate planning conditions can be applied to the proposed development to ensure internal noise levels compliant with LCC's requirements in the proposed accommodation are achieved, and that noise from any mechanical services plant is also appropriately controlled.

6.8 Based on this assessment, while noise from the surrounding event spaces are relatively high, internal noise level limits can be achieved with appropriate glazing and ventilation and as such noise should not be considered a determining factor in relation to any planning permission being sought.

FIGURE 1 – Site Location Identifying Monitoring Locations



APPENDIX A – Acoustic Terminology in Brief

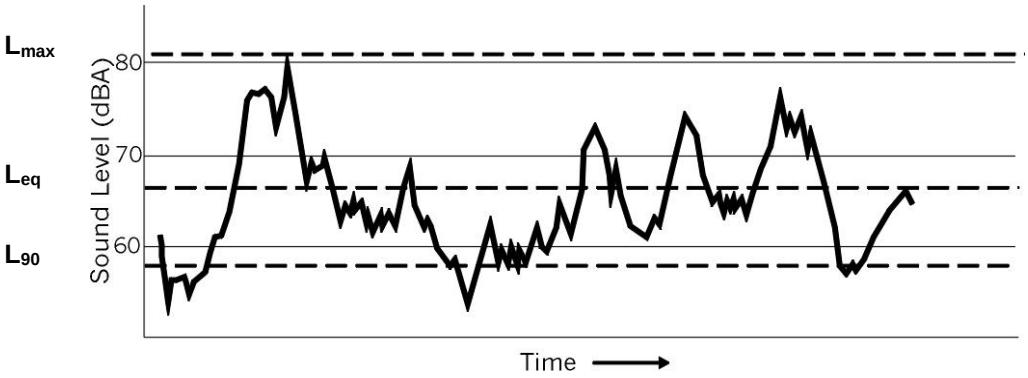
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz *(Hz)*, that is, cycles per second. The human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

Noise 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 noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



Example of Sound Level Varying With Time

$L_{Aeq,T}$	The equivalent continuous (A-weighted) sound level may be considered as the "average" sound level over a given time, T. It is used for assessing noise from various sources including transportation, industrial and construction sources and can be considered as the "ambient" noise level.
L_{A90}	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value used to describe the "background" noise.
L_{Amax}	The maximum (A-weighted) sound level during a measurement period.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
R_w	Single number rating used to describe the airborne sound insulation properties of a material or building element over the frequency range of typically 100-3150Hz.
$R_w + C_{tr}$	Single number rating used to describe the airborne sound insulation properties of a material or building element over the frequency range of typically 100-3150Hz, using a traffic noise spectrum as the source.
$D_{n,e,w}$	Weighted element-normalised level difference. Single number rating used to describe the performance of a ventilation unit.

APPENDIX B – Measurement Procedure

Dates & Times of Survey	Weekday Day: Tuesday 26 July 2016, between 1300 and 1700h Weekday Night: Monday 25 to Tuesday 26 July 2016, between 2300 and 0040h Weekend Night: Sunday 5 March
Personnel Present	Weekday Day: Paul Knowles (AEC) Weekday and Weekend Night: David Terry (AEC)
Equipment Used	Weekend Day: B&K 2260 Real Time Analyser (AEC Kit 2) Weekday and Weekend Night: B&K 2260 Real Time Analyser (AEC Kit 1)
Weather Conditions	Weekday Day: Dry, 18°C, 7/8 cloud cover and calm. Weekday Night: Dry, 10-15°C, 7/8 cloud cover skies and light breeze. Weekend Night: Dry , 6°C, 4/8 cloud cover skies and light breeze.
Measurement Procedure	Ambient, background and maximum noise levels were measured at five locations, identified as Locations A to E on Figure 1 and described below. A – On the corner of the site, 10m from St James Street carriageway. B – 1m from the northern elevation of the existing building. C – 1m from the carriageway of Newhall Street. D – 1 from the southern elevation of New Bird Street, opposite the gates to Lee Floorstok. E – In the southwest corner to the site, 20m from Hanger 34. All locations were selected to measure baseline noise levels, which were measured in terms of L_{Aeq}, L_{A10}, L_{A90} and L_{Amax} (fast response) typically over 5 to 15 minute periods. All the measurements were taken at a height of 1.5m above ground and all were free field measurements, with the exception of Locations B and D which was a façade measurement. The sound level analyser, which conforms to BS EN 61672-12003 *'Electro acoustics – sound level meters - Part1Specifications'* 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.
Measured Data	A summary of the results is presented in Tables B1, B2 and B3.

TABLE B1 – Measured Daytime Noise Levels

Location	Period, h	Noise Level, dB				Comments
		L_{Aeq}	L_{A10}	L_{A90}	$L_{Amax, F}$	
A	1311-1326	65.8	70.3	53.6	80.3	Road traffic on St James Street.
	1410-1425	65.1	69.5	53.8	80.9	
	1504-1519	64.6	59.0	51.5	76.5	
B	1328-1338	59.0	61.9	51.1	77.1	Road traffic on St James Street and Jordan Street, and construction noise from the north
	1430-1440	58.5	61.3	49.0	73.1	
	1525-1535	58.2	62.1	50.2	71.6	
C	1340-1350	56.5	59.5	48.7	73.9	Road traffic on Jordan Street and New Bird Street.
	1441-1451	55.1	57.2	48.7	75.6	
	1537-1547	54.9	54.0	49.0	83.8	
D	1359-1409	56.3	59.3	47.3	74.4	A combination of road traffic on St James Street and New Bird Street and activities in the service yard of Lee Floorstok Ltd.
	1453-1503	57.8	60.1	47.5	77.0	
	1548-1558	57.5	60.5	48.0	77.6	

TABLE B2 – Measured Weekday Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L_{Aeq}	L_{A90}	$L_{Amax, F}$	
A	2305-2315	57.0	42.2	74.2	Road traffic on St James Street.
	2354-0004	54.1	41.8	73.3	
	0044-0054	54.7	40.7	71.1	
B	2318-2328	50.9	38.5	66.6	Distant road traffic and occasional road traffic on Jordan Street.
	0005-0015	49.9	38.3	66.5	
C	2330-2340	45.9	39.7	57.4	Distant road traffic and occasional road traffic on Jordan Street and New Bird Street.
	0018-0028	42.2	39.4	50.1	
D	2343-2353	52.0	39.6	68.3	Distant road traffic and occasional road traffic on New Bird Street.
	0033-0043	47.3	39.4	62.4	

TABLE B3 – Measured Weekend Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L_{Aeq}	L_{A90}	$L_{Amax, F}$	
E	0253-0257	61.7	56.8	68.8	Amplified music breaking out of Hanger 34.
	0315-0320	60.3	54.6	67.7	
	0347-0340	55.3	51.4	64.9	Amplified music breaking out of Hanger 34, subjectively quieter.
	0358-0406	57.3	50.1	76.9	People leaving Hanger 34 and car pass bys.

APPENDIX C – National Planning Practice Guidance

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prev