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ACOUSTIC
CONSULTANTS

**EIGHTH DAY APARTMENTS, 111 OXFORD
ROAD, MANCHESTER**

ENVIRONMENTAL NOISE ASSESSMENT REPORT

architectural

environmental

occupational

industrial

noise control at source

project management

planning

legal services

expert witness

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1.0 SUMMARY

PDA Ltd was commissioned by Premier Estates to carry out an environmental noise and building envelope assessment report for the proposed replacement of existing windows at the Eighth Day Apartments development, 111 Oxford Road, in Manchester. The proposed development consists of the replacement of the existing timber frame windows to the apartments in the 6 storey mixed-use development comprising apartments at first to fifth floor levels and the Eighth Day Shop and Café at ground floor level, at 111 Oxford Road in Manchester.

The local noise climate is dominated by road traffic noise from Oxford Road with contributions from Mancunian Way A57(M) and other surrounding local roads. The road traffic is dominated by buses, but includes cars, lorries and motorbikes.

A pre-application consultation has been provided by Manchester City Council Technical Support Team Planning, which details their requirements for the proposed planning application (ref. 12541/FO/2019). Point 5 of the letter suggests:

5) The residential units within the development shall meet the following internal noise criteria:

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

Additionally, where entertainment noise is a factor in the noise climate the sound insulation scheme shall be designed to achieve internal noise levels in the 63Hz and 125Hz octave centre frequency bands so as not to exceed (in habitable rooms) 47dB and 41dB, respectively.

Based upon the measured noise levels, calculations have been undertaken for the Bedrooms and Living Spaces to evaluate the internal noise levels. With the glazing and ventilator specifications proposed in Section 6, calculations suggest that the MCC daytime and night time L_{Aeq} internal noise level requirements can be achieved.

In addition to the above, calculations have been undertaken to determine L_{Amax} noise levels within the bedrooms at night time; however due to constraints of the existing building, the calculated L_{Amax} values will not meet the MCC requested criteria that 'individual noise events shall not exceed 45 dB $L_{Amax,F}$ by more than 15 times'.

However we would consider that the above is acceptable given the following:

- Although the existing glass and ventilator specifications are unknown, a cursory inspection would suggest that they are likely to be standard types, therefore the proposed window specifications are likely to represent a significant increase in acoustic performance from that already experienced.
- The glazing and ventilator specifications proposed in this report are likely to be at the limit of what is achievable for an existing building, without significantly changing the façade and/or the ventilation strategy for building. It is therefore considered that it constitutes best practice within the constraints of the existing building.
- The assessment of L_{Amax} levels comes from WHO guidance from their Guidelines for Community Noise, however the document suggests, ' $L_{Aeq,T}$ should be used to measure continuing sounds, such as road traffic noise or types of more-or-less continuous industrial noises. Where there are no clear

reasons for using other measures, it is recommended that $L_{Aeq,T}$ be used to evaluate more-or-less continuous environmental noises'.

The dominant source of noise at this building is from road traffic from Oxford Road and surrounding local roads, therefore it is considered that the $L_{Aeq,T}$ should be used to evaluate the noise source as per WHO guidance. Calculations would suggest that the good practice guidance values of 35 dB L_{Aeq} during daytime, and 30 dB L_{Aeq} during night time, as adopted by MCC, can be achieved with the proposed specifications.

The potential for entertainment noise emission from adjacent bars in the locality has been considered. It is considered that it is unlikely that the MCC entertainment noise criteria would be exceeded within the proposed development.

2.0 BRIEF FOR CONSULTANCY

PDA Ltd was commissioned by Premier Estates to carry out the following for the proposed replacement of existing windows at the Eighth Day Apartments development, 111 Oxford Road, in Manchester.

- A) *We will travel to the site and carry out an ambient noise survey to assess the level of noise incident upon the proposed development. The measurement and assessment will include for noise from the adjacent road network, and other local noise sources.*

It is assumed that a secure location can be provided within the existing building, so that unmanned measurements can be taken with a microphone mounted out of an existing window, representative of daytime and night time hours at the site over a 24 hour period. Audio recordings would be taken to identify noise sources.

Due to the current Covid-19 pandemic noise levels may be lower than would otherwise be the case, therefore we would look to supplement the noise survey with models of the traffic noise levels based upon flow data, or existing noise survey reports available in the public domain.

We will carry out all noise surveys in accordance with the provisions of BS7445 "Description and Measurement of Environmental Noise". The measurements made will include both dBA and octave band noise levels including L_{eq} , L_{max} , and L_{90} parameters. During the survey duration, we will require unrestricted access to the site.

- B) *The results of the noise survey will be assessed in line with the requirements of the National Planning Policy Framework (NPPF) and MCC guidance internal noise levels (taken from BS8233:2014 guidance). We will carry out basic calculations, based on available room data/drawings, to predict internal noise levels within the development to compare with MCC criteria, and develop specifications for the building glazing and ventilation elements in support of your planning submission.*

We will produce a report detailing all survey procedure, measurements and results suitable for submission to the Local Authority in support of your planning application. We will suggest a scheme of sound insulation works (typically windows and ventilation openings) to ensure suitable internal noise levels within the development.

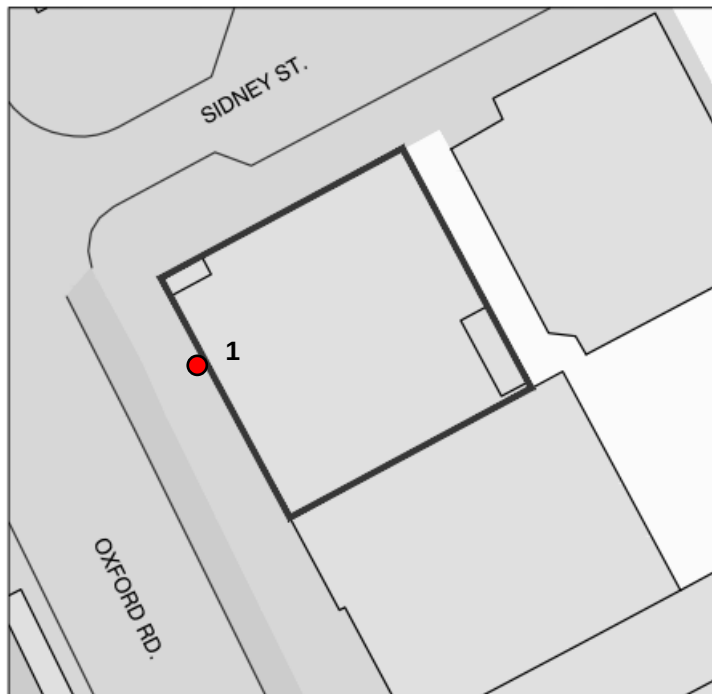
3.0 SITE DESCRIPTION

The proposed development consists of the replacement of the existing timber frame windows to the apartments in the 6 storey mixed-use development comprising apartments at first to fifth floor levels and the Eighth Day Shop and Café at ground floor level, at 111 Oxford Road in Manchester.

The site is bordered by Oxford Road (A34) to the west with Sidney Street to the north and residential buildings directly adjacent to the south and the LGBT+ Centre directly adjacent to the east. Oxford Road is a main bus route into central Manchester; approximately 50m north is the Mancunian Way A57(M) flyover. The surrounding area is a mix of commercial and residential uses with All Saints Park and the Manchester Metropolitan University All Saints Building directly opposite on Oxford Road.

A site plan showing the location of the site and surrounding local area is shown in Figure 1 below.

Figure 1: Site plan showing measurement position



4.0 NOISE ASSESSMENT CRITERIA

4.1 National Planning Policy Framework

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in June 2019. With regard to Noise the Framework states the following;

Planning policies and decisions should contribute to and 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.*

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:

- *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;*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

The terms 'significant adverse' and 'adverse' impacts are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE)' which states;

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. 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.

The notes also offer an explanation of the term 'adverse impacts' as follows;

... refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise, updated in July 2019. A summary is reproduced in Section 4.2 below, and the full document is published at <https://www.gov.uk/guidance/noise--2>. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

4.2 Planning Practice Guidance – Noise

The UK Planning Practice Guidance on noise offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL, reproduced in the table below.

Table 1: Planning Practice noise level guidance

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

4.3 Pre-application Consultation

A pre-application consultation planning letter has been provided by Manchester City Council Technical Support Team Planning, which details their requirements for the proposed planning application (ref. 12541/FO/2019). Point 5 of the letter suggests:

5) The residential units within the development shall meet the following internal noise criteria:

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

Additionally, where entertainment noise is a factor in the noise climate the sound insulation scheme shall be designed to achieve internal noise levels in the 63Hz and 125Hz octave centre frequency bands so as not to exceed (in habitable rooms) 47dB and 41dB, respectively.

You need to provide an acoustic report that shows that the new windows as proposed would satisfy the above criteria.

This report has been written for to address the above request. The guidance of the above has been taken from good practice guidance documents highlighted below.

4.4 BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

Dwelling houses, flats and rooms in residential use

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 2: BS8233 recommended indoor ambient noise levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedrooms	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

In addition BS 8233 suggests, '*regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values*'.

4.5 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following internal noise levels are applicable within dwellings.

Table 3: WHO Guidelines for Community Noise criteria

Specific Environment	Critical Health Effect(s)	L_{Aeq} dB	Time Base (hours)*
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16
Inside bedrooms	Sleep disturbance, night time	30	8

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

WHO Guidelines for Community Noise suggests, ‘the effect of a combination of noise events is related to the combined sound energy of those events (the equal energy principle). The sum of the total energy over some time period gives a level equivalent to the average sound energy over that period. Thus, $L_{Aeq,T}$ is the energy average equivalent level of the A-weighted sound over a period T. $L_{Aeq,T}$ should be used to measure continuing sounds, such as road traffic noise or types of more-or-less continuous industrial noises. However, when there are distinct events to the noise, as with aircraft or railway noise, measures of individual events such as the maximum noise level (L_{Amax}), or the weighted sound exposure level (SEL), should also be obtained in addition to $L_{Aeq,T}$.

Currently, the recommended practice is to assume that the equal energy principle is approximately valid for most types of noise and that a simple $L_{Aeq,T}$ measure will indicate the expected effects of the noise reasonably well. When the noise consists of a small number of discrete events, the A-weighted maximum level (L_{Amax}) is a better indicator of the disturbance to sleep and other activities.

Where there are no clear reasons for using other measures, it is recommended that $L_{Aeq,T}$ be used to evaluate more-or-less continuous environmental noises. Where the noise is principally composed of a small number of discrete events, the additional use of L_{Amax} or SEL is recommended’.

WHO guidelines indicates that exceedances of 45 dB L_{Amax} for single sound events should be limited to no more than 10 – 15 times per night, when measured with a ‘fast’ time weighting.

5.0 SURVEY DETAILS AND RESULTS

A noise level survey was undertaken at the site between 11:45 hours on Wednesday 17 March and 11:50 hours on Thursday 18 March 2021. The noise level surveys were chosen to be representative of likely full daytime and night time hours.

Measurements were taken at one measurement position. The measurement position is detailed in Figure 1 in Section 3.

- Position 1 – microphone located on a pole out of a 3rd floor level window approximately 10m above ground level with line of sight to Oxford Road.

The measurement position was chosen to be representative of the front façade of the existing building.

The measurements were made and partially attended by Mr Stefan Fox Marshall of PDA Ltd. Measurements were of continuous 5 minute samples. The survey was conducted using an NTi XL2 sound level meter for which calibration certificates are held. The NTi sound level meter has a Class 1 frequency response as per BS EN 61672-1:2003. For the survey the sound level meter was field calibrated both before and after the measurement period, during which time no significant deviation from the calibrated level was observed. The sound level meter was fitted with a microphone windshield at all times.

The microphone of the sound level meter at Position 1 was mounted on a pole position 1m from the front façade and can be assumed to be a façade measurement. All measurements were undertaken with a fast time-weighting and broadband statistics were measured throughout. In addition, octave band frequency spectra were recorded along with audio recordings.

The weather during the noise surveys was dry with reported wind speeds of no more than 4m/s, temperatures of between 1 – 11 degrees centigrade, and total cloud cover. The weather was considered conducive to undertaking noise measurements.

Noise Sources

The local noise climate is dominated by road traffic noise from Oxford Road with contributions from Mancunian Way A57(M) and other surrounding local roads. The road traffic is dominated by buses, but includes cars, lorries and motorbikes.

It is noted that there are a number of bars and pubs in the surrounding locality notably òL at Hatch located under the Mancunian Way underpass, which is at least 50m away from the existing building, and Flour and Flagon, Deaf Institute and The Footage on Grosvenor Street which are located one block away (over 100m). None of the surrounding bars have a direct line of sight to the existing building. Although none of the bars was operating at the time of the noise survey due to Covid-19 restrictions, it is considered that these are unlikely to contribute at the existing building where the road traffic noise is already significant.

5.1 Measurement Results

Full details of the measured results can be seen in Appendix III included at the end of this report. Measurement positions on site are shown on Figure 1 in Section 3 of this report. A summary of the results is given below:

Table 4: Summary of environmental noise measurements – Position 1 (front)
Wednesday 17 – Thursday 18 March 2021

Position	Time Period (hh:mm)	Duration (hh:mm)	$L_{Aeq,T}$ (dB)	Range of $L_{Amax,5mins}$ (dB)	Range of $L_{A90,5mins}$ (dB)
1	Day 11:45 – 23:00	11:15	70	73 – 99	58 – 67
	Night 23:00 – 07:00	08:00	65	69 – 91	44 – 66
	Day 07:00 – 11:50	04:50	70	74 – 91	63 – 67
	Average Daytime	16:05	70		

5.2 Day and Night time noise level predictions

Internal noise level predictions are to be undertaken based upon the measured day and night time noise levels. The noise levels measured above were taken at approximately 1m from the façade of the existing building and are therefore façade measurements; therefore a correction of -2.5dB has been taken to convert to free-field noise levels to take into account the reflection from the building façade.

The noise levels measured at Position 1 are to be used for the front of the proposed dwellings fronting Oxford Road with corrections made for distance attenuation to account for the respective floor levels (± 1.2 dB for L_{Aeq} and ± 2 dB for L_{Amax}). The noise levels measured been corrected by -3dB to account for the side façade on Sidney Street, with -10dB for the rear façade due to shielding and distance attenuation from the surrounding roads.

5.3 Effects of Covid-19 Pandemic

The measurements undertaken by PDA Ltd above were undertaken during a period of lockdown due to the Covid-19 pandemic. The effect of the pandemic (if any) upon the measured noise levels is unknown, therefore additional data has been assessed using Department for Transport Road Traffic Counts, the results of which are summarised below.

Calculation of Road Traffic Noise

The noise level emissions from Oxford Road have been verified according to the calculation methods of CRTN (Calculation of Road Traffic Noise 1988) from road traffic count data from the Department for Transport (DfT) Road Traffic Statistics website.

We have taken data for the A34 Oxford Road based upon an estimated traffic count from 2019 which indicates the AADF (annual average daily flow). The data suggests that there were 5,463 motor vehicles, of which 2717 are classed as heavy vehicles (Buses, coaches, LGVs and HGVs, etc) or 49.8%.

It should be noted that the calculation methods in CRTN used for the assessment predict noise levels in terms of $L_{A10,18h}$. We have calculated the noise levels in terms of daytime L_{Aeq} according to the prediction methods detailed in the report *Converting The UK Traffic Noise Index $L_{A10,18h}$ To EU Noise Indices For Noise Mapping (PR/SE/451/02)* prepared by TRL Ltd on behalf of DEFRA. Based upon the traffic flow data and the calculation methods of CRTN, the calculation suggests a calculated noise level of 68.1 dB L_{Aeq} at a distance of 10m from the road during the daytime.

The predicted noise level is considered to be consistent with that measured during the PDA Ltd noise survey and therefore no further corrections have been made for the effects of the Covid-19 pandemic lockdown.

5.4 Discussion

It is PDA's experience that developments with the measured noise levels above are suitable for residential development provided that adequate acoustic attenuation is provided to habitable areas, however it is recognised in this situation that the levels of sound attenuation achievable are limited by the constraints of the existing building, e.g. ventilation strategy with slot trickle ventilators, etc.

Considering the acoustic weak points of a building façade, typically the glazing and the ventilation elements, calculations have been undertaken to determine the internal noise levels. These levels are compared with the criteria detailed in Table 5 below, derived from the Pre-application criteria proposed by Manchester City Council in Section 4.

Table 5: Proposed internal noise level criteria

Space	$L_{Aeq,T}$ dB	Time Base (hours)
Living Rooms, Daytime	35	16 (07:00 – 23:00 hours)
Bedrooms, Night time	30	8 (23:00 – 07:00 hours)

In addition for bedrooms at night time (23:00 – 07:00) MCC has requested that '*individual noise events shall not exceed 45 dB $L_{Amax,F}$ by more than 15 times*'. The practicalities of achieving these criteria have been assessed.

6.0 NOISE LEVEL PREDICTIONS

Based upon the measured noise levels in Section 5, calculations have been undertaken to determine internal noise levels for the existing dwellings. The exact dimensions of the existing building internal layout are presently unknown and the Client has been unable to provide any Plans for the building. Existing and Proposed elevation drawings have been provided by Cube Architects, Drawing ref. CPS 19 052 200 and 201, dated August and October 2019.

For the purposes of the calculations the following dimensions have been assumed for the rooms taken from similar typical projects: Bedroom floor area 10m², room height 2.4m, volume 24m³, façade area including glazing 7.2m². Living Room floor area 25m², room height 2.4m, volume 60m³, façade area including glazing 9.6m². As it is unknown which of the windows corresponds to which relative room (Bedroom or Living Room), each of the window types has been assessed for each space. It has been assumed that there is 1 no. window type per room. It has further been assumed that there are 2 no. trickle ventilators located in each window per room as appears to be the case from inspection of the external façade.

The window dimensions taken from Cube Architect's drawing CPS 19 052 201 are as follows: Window Type 1: 2680mm × 1760mm (Oxford Road façade), 2680mm × 1855mm (Sidney Street façade), 2705mm × 1730mm (Rear façade); Window Type 2: 1730mm × 1145mm; Window Type 3: 1230mm × 3610mm (Oxford Road façade), 3580mm × 1190mm; Window Type 4: Fully glazed façade (3000mm × 2400mm for bedrooms, 4000mm × 2400mm for Living Rooms); Window Type 5: 1585mm × 1810mm; Window Type 6: 1245mm × 1225mm; Window Type 7: 675mm × 1750mm.

6.1 Glazing and Ventilation Attenuation Requirements

The dominant paths for noise transfer to the interior of buildings are generally the glazing and ventilation elements of the façade constructions. Based on this premise, to achieve the required internal noise levels from Table 5 would require the following glazing and ventilation specifications.

The calculation of noise break-in to the residential rooms has been undertaken in accordance with the calculation methods of BS EN 12354-3:2000 *Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements. Part 3: Airborne sound insulation against outdoor sound*, in octave bands. Reverberation time is 0.5 seconds as per the BS EN 12354-3 reference time for dwellings.

Table 6: Glazing and Ventilator Schedule

Façade	Floor	Room	Minimum Glazing Rating R_w dB	Minimum Ventilator Rating $D_{n,e,w}$ dB ¹	Internal Noise Level Target	Calculated Internal Noise Level
					$L_{Aeq,T}$ dB Day/Night	$L_{Aeq,T}$ dB Day/Night
Oxford Road	All	Living Room	38	44	35/-	33/-
Oxford Road	All	Bedroom	45	44	35/30	34/30
Sidney Street	All	Living Room	38	38	35/-	35/-
Sidney Street	All	Bedroom	41	44	35/30	34/30
Rear	All	Living Room	38	33	35/-	30/-
Rear	All	Bedroom	38	33	35/30	33/29

Notes¹ Assumes 2 no. trickle ventilators per window/room – rating for each ventilator

Discussion

With the glazing and ventilator specifications proposed in Table 6 above, calculations suggest that the MCC L_{Aeq} daytime and night time internal noise level requirements can be achieved.

In addition to the above, calculations have been undertaken to determine L_{Amax} noise levels within the bedrooms at night time. Using the full night time L_{Amax} noise levels measured at Position 1, with the glazing and ventilation specifications above, the calculated L_{Amax} values will not meet the MCC requested criteria that *'individual noise events shall not exceed 45 dB $L_{Amax,F}$ by more than 15 times'*.

Noise break-in is dominated by the slot trickle ventilators that are located within the windows. The calculations assume that 2 no. trickle ventilators per room/window are required as seen in the existing windows. It should be noted that a trickle ventilator with rating of 44 dB $D_{n,e,w}$ has been assumed within the calculations which it is considered to be at the practical limit for what is achievable for a slot ventilator. Higher performance values are available from ventilators, however these are typically demonstrated by through-wall ventilators or over the frame ventilators, or through use of a mechanical ventilation system, which may significantly change the building façade and/or ventilation strategy for the building. Therefore it is concluded that it is not possible to meet the MCC L_{Amax} criteria within the constraints of the existing building. Calculations would suggest that for the front façade, there would be less than 15 no. exceedances of 48 dB L_{Amax} . The exceedance of L_{Amax} 45 dB no more than 15 times a night may be achieved on the rear façade with the proposed specifications.

However we would consider that the above is acceptable given the following:

- Although the existing glass and ventilator specifications are unknown, a cursory inspection would suggest that they are likely to be standard types, therefore the proposed specifications are likely to represent a significant increase in acoustic performance from that already experienced.
- The glazing and ventilator specifications proposed are likely to be at the limit of what is achievable for an existing building, without significantly changing the façade and/or the ventilation strategy for building. It is therefore considered that it constitutes best practice within the constraints of the existing building.
- The assessment of L_{Amax} levels comes from WHO guidance from their Guidelines for Community Noise, however the document suggests, ' $L_{Aeq,T}$ should be used to measure continuing sounds, such as road traffic noise or types of more-or-less continuous industrial noises. However, when there are distinct events to the noise, as with aircraft or railway noise, measures of individual events such as the maximum noise level (L_{Amax}), or the weighted sound exposure level (SEL), should also be obtained in addition to $L_{Aeq,T}$... Where there are no clear reasons for using other measures, it is recommended that $L_{Aeq,T}$ be used to evaluate more-or-less continuous environmental noises. Where the noise is principally composed of a small number of discrete events, the additional use of L_{Amax} or SEL is recommended'.

The dominant source of noise at this building is from road traffic from Oxford Road and surrounding local roads, therefore it is considered that the $L_{Aeq,T}$ should be used to evaluate the noise source as per WHO guidance. Calculations would suggest that the good practice guidance values of 35 dB L_{Aeq} during daytime, and 30 dB L_{Aeq} during night time, as adopted by MCC, can be achieved with the proposed specifications. The WHO guidance

suggests that L_{Amax} should be used to evaluate distinct events to the noise, such as aircraft or railway noise, neither of which is present at this site, therefore it is considered that the L_{Amax} criteria is not applicable to this particular building.

6.1.1 Glazing Specification and Installation Notes

Notes on Glazing Installation

For the glazing specifications in Table 6, all sound insulation values quoted must be achieved by the overall **combination of frame and glazing**, and not just by the glazing alone. The frame should not reduce the performance of the system overall.

Glazing framing systems must be fully sealed with any small gaps (<10mm nominal) around the perimeter to be stuffed with dense mineral wool to full frame depth and sealed both sides with acoustic non-setting mastic, with additional weathering protection to be applied additionally externally to this. No gaps should be left unsealed.

Minimum performance requirements used in the calculations for the combination of glazing and framing recommended in the above tables are as follows:

Table 7: Required Minimum Sound insulation of Combined Glazing and Framing

Typical Product	Minimum Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz)							R_w dB
	63	125	250	500	1k	2k	4k	
Acoustic double glazing e.g. 12/20/12.8mm acoustic laminate	26	36	37	43	42	47	55	45
Acoustic double glazing e.g. 10.8/16/6mm acoustic laminate	21	25	28	38	45	44	56	41
Acoustic double glazing e.g. 10/12/6mm	20	26	27	34	40	38	46	38

Figures stated in the table above are based on Pilkington and Saint Gobain manufacturer quoted data. Acoustic ratings should be checked with the manufacturer and supported by laboratory test reports where necessary.

6.1.2 Ventilator Requirements

BS8233:2014 would suggest, *the Building Regulations' supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.*

The ventilator inlets described in the following table are calculated to provide adequate sound insulation to maintain internal noise levels compliant with the guidance criteria when used in conjunction with the selected glazing. Example ventilator products are noted below.

The acoustic specification relates to assumption that 2 no. ventilators are required within each window/room as seen on the existing façade. The stated performance is for each ventilator. Where more than 2 no. ventilators per window/room are required to meet the ventilation requirement, it may not be practical to meet the internal noise level requirements with slot ventilators. Requirements should be checked with the

manufacturer. Please note that the treatment is generally not considered necessary for non-habitable rooms such as bathrooms etc.

Table 8 below gives the acoustic performance of the ventilators used in the calculations. Any alternative vent should achieve the same performance or greater in each octave band.

Table 8: Required ventilator performance

Example Product	Minimum Normalised Element Level Difference $D_{n,e}$ (dB) at Octave Band Centre Frequency (Hz)						$D_{n,e,w}$ dB
	125	250	500	1k	2k	4k	
Acoustic trickle vent e.g. Greenwood EHA574	34	40	39	42	49	49	44
Acoustic trickle vent e.g. Simon Acoustic EHAS	40	36	34	35	44	40	38
Acoustic trickle vent e.g. Simon Acoustic Framevent	39	36	35	31	32	37	33

Please note that the specification of vents is in terms of acoustic performance only. Ventilation strategy needs to be checked with Local Authority and other standards and regulations for compliance. It should be noted that inclusion of ventilators alone does not ensure compliance with Building Regulations or other regulatory requirements for ventilation. The ventilation strategy should be checked by others.

6.2 External Walls

It is assumed that the proposed façades for the flats are a traditional cavity brick/blockwork construction, consisting of 100mm brick/block outer leaf, minimum 100mm cavity and 100mm blockwork inner leaf with internal finish. From acoustic test data for similar constructions, it is assumed that the build-up has an acoustic performance of at least 54 dB R_w .

Please note that the external façade should have no unsealed penetrations, and any openings for ventilation should meet the specifications for ventilators above.

6.3 Entertainment Noise

The pre-application consultation planning letter suggests:

Additionally, where entertainment noise is a factor in the noise climate the sound insulation scheme shall be designed to achieve internal noise levels in the 63Hz and 125Hz octave centre frequency bands so as not to exceed (in habitable rooms) 47dB and 41dB, respectively.

As previously noted there are a number of bars and pubs in the surrounding locality notably öL at Hatch located under the Mancunian Way underpass, which is at least 50m away from the existing building, and Flour and Flagon, Deaf Institute and The Footage on Grosvenor Street which are located one block away (over 100m). None of the surrounding bars have a direct line of sight to the existing building.

Considering potential noise emissions from öL at Hatch located under the Mancunian Way underpass as a worst case, if the MCC entertainment noise criteria above were added to the noise reduction for distance attenuation, line of sight shielding, and the proposed reduction of the glazed/ventilator specified in Section 6.1 above, the following noise level limits may be calculated at the source:

Table 9: Entertainment noise levels

Element	Noise Level dB, Octave Band Centre Frequency Hz	
	63 Hz	125Hz
MCC Entertainment Noise criteria	47	41
Reduction for Distance Attenuation 50m	34	34
Shielding correction	5	5
Sound Reduction of façade glazing/ventilation	23	26
Sum of the above	109	106

From the above calculation, the noise level emission directly outside öL at Hatch would need to exceed a level of 109 dB at 63 Hz, or 106 dB at 125Hz to cause exceedance of the MCC entertainment noise criteria internally within the existing development. It is considered that these noise levels are highly unlikely to be emitted outside a standard city center bar and therefore the MCC entertainment noise criteria would not be exceeded within the proposed development. It is likely that the noise due to road traffic already assessed above, which is significant even during the early morning hours, will be the dominant noise source incident upon the proposed development, and any entertainment noise, even if it were to exist, would likely be far below this level.

6.4 Quality Control

Please note that achieving performance standards requires strict adherence to best practice construction methodology on site. A checklist of acoustic requirements for quality control is attached at the rear of this report.

7.0 CONCLUSIONS

PDA Ltd was commissioned by Premier Estates to carry out an environmental noise and building envelope assessment report for the proposed replacement of existing windows at the Eighth Day Apartments development, 111 Oxford Road, in Manchester. The proposed development consists of the replacement of the existing timber frame windows to the apartments in the 6 storey mixed-use development comprising apartments at first to fifth floor levels and the Eighth Day Shop and Café at ground floor level, at 111 Oxford Road in Manchester.

The local noise climate is dominated by road traffic noise from Oxford Road with contributions from Mancunian Way A57(M) and other surrounding local roads. The road traffic is dominated by buses, but includes cars, lorries and motorbikes.

Based upon the measured noise levels, calculations have been undertaken for the Bedrooms and Living Spaces to evaluate the internal noise levels. With the glazing and ventilator specifications proposed in Section 6, calculations suggest that the MCC L_{Aeq} daytime and night time internal noise level requirements can be achieved.

In addition to the above, calculations have been undertaken to determine L_{Amax} noise levels within the bedrooms at night time; however due to constraints of the existing building, the calculated L_{Amax} values will not meet the MCC requested criteria that *'individual noise events shall not exceed 45 dB $L_{Amax,F}$ by more than 15 times'*.

However we would consider that the above is acceptable given the following:

- Although the existing glass and ventilator specifications are unknown, a cursory inspection would suggest that they are likely to be standard types, therefore the proposed window specifications are likely to represent a significant increase in acoustic performance from that already experienced.
- The glazing and ventilator specifications proposed in this report are likely to be at the limit of what is achievable for an existing building, without significantly changing the façade and/or the ventilation strategy for building. It is therefore considered that it constitutes best practice within the constraints of the existing building.
- The assessment of L_{Amax} levels comes from WHO guidance from their Guidelines for Community Noise, however the document suggests, *' $L_{Aeq,T}$ should be used to measure continuing sounds, such as road traffic noise or types of more-or-less continuous industrial noises. Where there are no clear reasons for using other measures, it is recommended that $L_{Aeq,T}$ be used to evaluate more-or-less continuous environmental noises'*.

The dominant source of noise at this building is from road traffic from Oxford Road and surrounding local roads, therefore it is considered that the $L_{Aeq,T}$ should be used to evaluate the noise source as per WHO guidance. Calculations would suggest that the good practice guidance values of 35 dB L_{Aeq} during daytime, and 30 dB L_{Aeq} during night time, as adopted by MCC, can be achieved with the proposed specifications.

The potential for entertainment noise emission from adjacent bars in the locality has been considered. It is considered that it is unlikely that the MCC entertainment noise criteria would be exceeded within the proposed development.

Appendix I – Definition of Acoustic Terms (Environmental)

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see below). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see below). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} , etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.

Appendix II – Acoustic Requirements for Quality Control

1. Blockwork

All blockwork to be mortared to an almost fair faced standard both horizontally and vertically. Only perfect blocks may be used with no pitting or cracks. The blockwork must seal effectively to the underside of the soffit.

Where blockwork walls form a cavity wall, care should be taken to avoid rubble and snots from bridging the cavity. This is especially important where one or more of the leaves is floating.

2. Plasterboard

All plasterboard joints are to be butted tight. The rule of thumb is that the joint should be tight enough over its entire length to prevent a normal business card from being inserted. Multiple layers should be fitted with staggered joints.

Base details and deflection heads are to be as per the British Gypsum White Book, or similar approved, with copious amounts of mastic to be used to seal the joints to the floor and ceiling respectively.

3. Mineral Fibre

Mineral fibre slabs are to be butted tightly together and to boundary structures, to form a homogeneous layer.

4. Windows

All window frames are to be a good tight fit into the building structure with any gaps to be filled both internally and externally with a non-setting mastic in addition to the usual weather proofing seal to the exterior. Any gaps between the frame and building that are greater than 5mm are to be packed with a dense mineral fibre prior to mastic sealing.

5. Electrical Sockets

Electrical sockets must not be fitted back to back and removed areas of blockwork and plasterboard should be kept to an absolute minimum.

6. Water Pipes

All water pipes (and any other pipework) are to be resiliently mounted to avoid “water hammer”. This is particularly important for plasterboard walls.

7. Penetrations

Details for specific services penetrations may be supplied upon request.

8. Approved Samples and Inspections

Samples of each individual acoustic element should be provided for inspection at the beginning of its installation. Once approved, the Clerk of Works must ensure that the same level of quality continues throughout construction.

Appendix III – Environmental Noise Measurement Results

Position 1 – Front of site 17/18 March 2021

Period	Time	<i>L_{eq} dB, Octave band centre frequency Hz</i>								<i>L_{Aeq} dB</i>	<i>Range of L_{Amax} dB</i>	<i>Range of L_{A90} dB</i>
		63	125	250	500	1k	2k	4k	8k			
Day	11:45 – 23:00	74	65	65	64	67	61	56	48	70	73 – 99	58 – 67
Night	23:00 – 07:00	69	63	62	62	62	57	50	46	65	69 – 91	44 – 66
Day	07:00 – 11:50	75	65	65	65	66	61	60	52	70	74 – 91	63 – 67
Day	Average	74	65	65	64	67	61	57	50	70		

