

1&2 Wesley Gate, Queens Road Reading

Noise Impact Assessment
Report 19617.NIA.02 Rev A

Highfield Assessors
Old Walsall Bus Station
St Pauls Street
Walsall
WS1 1NR

First Issue date: 08/11/2019			
Revision History			
Report 19617.NIA.02			
A	04/12/2019 Report amended with currently proposed non-glazed element build up	D	
B		E	
C		F	
Written by:		Checked by:	
Daniel Green MIOA Senior Acoustic Consultant		Aidan Tolkien MIOA Senior Acoustic Consultant	
Approved by:			
Kyriakos Papanagiotou MIOA Managing Director			
Disclaimer KP Acoustics Ltd. has used reasonable skill and care to complete this technical document, within the terms of its brief and contract with the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the stated scope. This report is confidential to the client and we accept no responsibility to third parties to whom this report, or any part thereof, is made known. KP Acoustics Ltd. accepts no responsibility for data provided by other bodies and no legal liability arising from the use by other persons of data or opinions contained in this report. KP Acoustics Ltd. 2019			

Contents

SUMMARY	1
1.0 INTRODUCTION	2
2.0 SITE SURVEYS	2
2.1 Site Description	2
2.2 Environmental Noise Survey Procedure	2
2.3 Measurement Positions	2
2.4 Equipment	3
3.0 RESULTS	4
3.1 Noise Survey	4
4.0 NOISE ASSESSMENT GUIDANCE	5
4.1 Noise Policy Statement For England 2019	5
4.2 ProPG: Planning and Noise	7
4.3 BS8233:2014	7
4.4 WHO Guidelines for Community Noise (1999)	8
4.5 ANC Residential Design Guide to Acoustics, Ventilation and Overheating	8
5.0 EXTERNAL BUILDING FABRIC SPECIFICATION	12
5.1 Non-Glazed Elements	12
5.2 Glazed Elements	13
6.0 VENTILATION AND OVERHEATING	14
6.1 Ventilation Strategy	14
6.2 Overheating Control Strategy	14
7.0 EXTERNAL AMENITY AREA ASSESSMENT	16
8.0 CONCLUSION	17

List of Attachments

19617.TH1-2	Environmental Noise Time Histories
Appendix A	Glossary of Acoustics Terminology

SUMMARY

KP Acoustics Ltd has been commissioned by Highfield Assessors, Old Walsall Bus Station, St Pauls Street, Wallsall, WS1 1NR, to assess the suitability of the site at 1&2 Wesley Gate, Queens Road, Reading, RG1 4AP for a roof extension to create four flats above an existing office building (which has an unimplemented change of use from B1 to C3 under permitted development) in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

Environmental noise surveys have been undertaken on site in order to establish the current ambient noise levels, as shown in Table 3.1.

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed elements in order to meet the requirements of BS8233:2014, taking into consideration the non-glazed external building fabric elements. The results of these calculations and the sound reduction performance requirements for the glazed elements are shown in Table 5.2.

The noise implications of the ventilation strategy have been considered, with options being provided to ensure that the ventilation requirements of Approved Document F are achieved.

Noise levels within external amenity areas would be expected to meet the recommended levels provided within BS8233:2014.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by Highfield Assessors, Old Walsall Bus Station, St Pauls Street, Wallsall, WS1 1NR, to assess the suitability of the site at 1&2 Wesley Gate, Queens Road, Reading, RG1 4AP for a roof extension to create four flats above existing office building (which has an unimplemented change of use from B1 to C3 under permitted development) in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

This report presents the results of the environmental survey undertaken in order to measure prevailing background noise levels and outlines any necessary mitigation measures.

2.0 SITE SURVEYS

2.1 Site Description

The site is bounded by Queen's Road (A329) to the north and commercial and residential buildings on other sides. At the time of the survey, the background noise climate was dominated by road traffic noise from Queen's Road (A329).

2.2 Environmental Noise Survey Procedure

Noise surveys were undertaken on the proposed site as shown in Figure 2.1. The locations were chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources. Continuous automated monitoring was undertaken for the duration of the survey between 13:14 on 31/10/2019 and 14:14 on 01/11/2019.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Measurement Positions

Measurement positions are as described within Table 2.1 and shown within Figure 2.1.

Icon	Descriptor	Location Description
	Noise Measurement Position 1	The meter was installed on a second-floor window overlooking Queen's Road. A correction of 3dB has been applied to account for non-free field conditions
	Noise Measurement Position 2	The meter was installed on a first-floor window overlooking the rear parking area. A correction of 3dB has been applied to account for non-free field conditions

Table 2.1 Measurement positions and descriptions



Figure 2.1 Site measurement positions (Image Source: Google Maps)

2.4 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

Measurement instrumentation		Serial no.	Date	Cert no.
Kit 4	Svantek Type 957 Class 1 Sound Level Meter	12398	22/02/2018	14008252-1
	Aco Pacific 7052E Free-field microphone	64232		
	Preamp Svantek SV12L	62632		
	Svantek External windshield	N/A	N/A	N/A
Kit 9	Svantek Type 958A Class 1 Sound Level Meter	36655	13/12/2017	14007250-4
	Free-field microphone MTG MK250	10877		
	Preamp Svantek 2v12L	33695		

	Svantek External windshield	-	-	-
	B&K Type 4231 Class 1 Calibrator	2147411	04/02/2019	04130/1

Table 2.2 Measurement instrumentation

3.0 RESULTS

3.1 Noise Survey

The $L_{Aeq}: 5min$, $L_{Amax}: 5min$, $L_{A10}: 5min$ and $L_{A90}: 5min$ acoustic parameters were measured throughout the duration of the surveys. Measured levels are shown as time histories in Figures 19617.TH1-2. Measured noise levels are shown in Table 3.1.

Time Period	Noise Measurement Position 1 (Measured Noise level – dBA)	Noise Measurement Position 2 (Measured Noise level – dBA)
Daytime $L_{Aeq,16hour}$	71	56
Night-time $L_{Aeq,8hour}$	66	49

Table 3.1 Measured average noise levels for daytime and night-time

The proposed rooftop extension is as shown in Figure 2.2. It should be noted that noise levels incident upon the new façades would be reduced due to additional screening provided by the parapet wall.

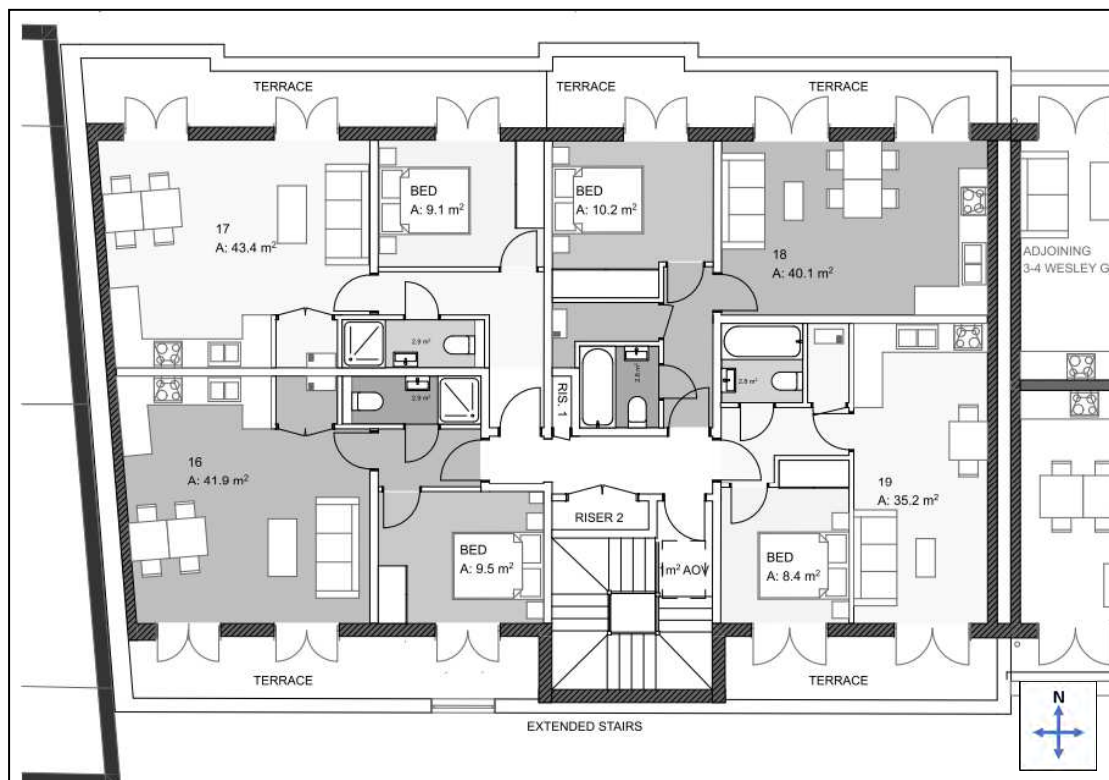


Figure 2.2 Proposed rooftop extension

Barrier calculations have been undertaken in order to predict expected levels at the set back façades, which are shown in Table 3.2.

Time Period	Noise Level Incident Upon the North Façade	Noise Level Incident Upon the South Façade
Daytime $L_{Aeq,16hour}$	59	51
Night-time $L_{Aeq,8hour}$	54	44

Table 3.2 Site average noise levels for daytime and night time at proposed façade

For the front façade, the distance from source to barrier has been assumed to be 8 metres which is approximately the centre point of the carriageway. For the rear façade, the performance of the barrier has been capped at an overall reduction of 5dB due to the sporadic nature of the traffic noise using the carpark to the rear.

4.0 NOISE ASSESSMENT GUIDANCE

4.1 Noise Policy Statement For England 2019

The National Planning Policy Framework (NPPF) has superseded and replaces Planning Policy Guidance Note 24 (PPG24), which previously covered issues relating to noise and planning in England. Paragraph 170 of the NPPF states that planning policies and decisions should aim to:

- 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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans

In addition, Paragraph 180 of the NPPF 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’:*

- 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 Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the aim to ‘Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.’

Noise Policy Statement England (NPSE) noise policy aims are as follows:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life*

The Noise Policy Statement England (NPSE) outlines observed effect levels relating to the above, as follows:

- 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.
- SOAEL – Significant Observed Adverse Effect Level
 - This is the level above which significant adverse effects on health and quality of life occur.

As stated in The Noise Policy Statement England (NPSE), it is not currently possible to have a single objective based measure that defines SOAEL that is applicable to all sources of noise in all situations. Specific noise levels are not stated within the guidance for this reason, and allow flexibility in the policy until further guidance is available.

4.2 ProPG: Planning and Noise

As outlined above, the National Planning Policy Framework encourages improved standards of design, although it provides no specific noise levels which should be achieved on site for varying standards of acoustic acceptability, or a prescriptive method for the assessment of noise.

ProPG: Planning and Noise was published in May 2017 in order to encourage better acoustic design for new residential schemes in order to protect future residents from the harmful effects of noise. This guidance can be seen as the missing link between the current NPPF and its predecessor, PPG24 (Planning Policy Guidance 24: Planning and Noise), which provided a prescriptive method for assessing sites for residential development, but without the nuance of ‘good acoustic design’ as outlined in ProPG.

ProPG allows the assessor to take a holistic approach to consider the site’s suitability, taking into consideration numerous design factors which previously may not have been considered alongside the noise level measured on site, for example the orientation of the building in relation to the main source of noise incident upon it.

It should be noted this document is not an official government code of practice, and neither replaces nor provides an authoritative interpretation of the law or government policy, and therefore should be seen as a good practice document only.

4.3 BS8233:2014

BS8233:2014 ‘*Sound insulation and noise reduction for buildings*’ describes recommended internal noise levels for residential spaces. These levels are shown in Table 4.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB(A)	-
Dining	Dining Room/area	40 dB(A)	-
Sleeping (daytime resting)	Bedrooms	35 dB(A)	30 dB(A)

Table 4.1 BS8233 recommended internal background noise levels

It should be noted that the recommended internal noise levels outlined above are not applicable under “purge ventilation” conditions as defined by Approved Document F of the Building Regulations, as this should only occur occasionally (E.G. to remove odour from painting or burnt food). However, the levels above should be achieved whilst providing sufficient background ventilation, either via passive or mechanical methods.

The external building fabric would need to be carefully designed to achieve these recommended internal levels.

In addition to guidance on internal levels, BS8233:2014 also states the following with regards to noise within external amenity spaces:

‘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 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$, 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.’

As outlined above, the resulting noise levels in external amenity areas should not be a reason for refusal, providing that the noise levels are designed to be as low as practically possible within external amenity areas.

Expected levels within the proposed external amenity areas are outlined in Section 7.0 in more detail.

4.4 WHO Guidelines for Community Noise (1999)

WHO Guidelines for Community Noise (1999) recommends that internal noise levels for individual events should not exceed 45dB L_{Amax} more than 10-15 times per night.

It should be noted that this impact is increasingly being regarded as ‘LOAEL’ for this number of exceedances, as described in Section 4.1.

The external building fabric would need to be carefully designed to ensure that the above guidance is achieved.

4.5 ANC Residential Design Guide to Acoustics, Ventilation and Overheating

The ANC guide to acoustics, ventilation and overheating provides an integrated approach to achieving good acoustic design with the ventilation requirements of Approved Document F of the Building Regulations and consideration for overheating control. This good practice document recognises the interdependence of ventilation and overheating when assessing

noise and provides a methodology for assessing the noise implications surrounding ventilation and overheating control.

Ventilation

The ANC Guide to Acoustics, Ventilation and Overheating states the following with regards to ventilation:

‘It is important to differentiate between the need to provide ‘purge ventilation’ as required occasionally under Part F, which applies to all building types, in all locations and throughout the year; against the need to provide ventilation for the ‘overheating condition’ which is influenced by the location, orientation, type and design of the building and may be required for sustained periods of time, or not at all, depending on the overheating risk...

Approved Document F outlines the three main types of ventilation as whole house ventilation (continuous ventilation of rooms or spaces at a relatively low rate to dilute and remove pollutants and water vapour), extract ventilation (typically for kitchens or bathrooms), and purge ventilation (manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and / or water vapour, provided by natural or mechanical means).

It also provides four template systems which can be adopted to demonstrate compliance with the Building Regulations, which are outlined in Table 4.2 below.

Ventilation System	Provision with ADF System / Purpose		
	Whole Dwelling Ventilation	Extract Ventilation	Purge Ventilation
System 1 – Trickle vents & intermittent extract fans	Trickle vents	Intermittent extract fans	Typically provided by opening windows
System 2 – Passive stack	Trickle vents and passive stack ventilation	Continuous via passive stack	Typically provided by opening windows
System 3 – Cont. mechanical extract (MEV)	Continuous mechanical extract – min. low rate Trickle vents for inlet air	Continuous mechanical extract – min. high rate Trickle vents for inlet air	Typically provided by opening windows
System 4 – Cont. mechanical supply & extract with heat recovery (MEV)	Continuous mechanical supply and extract – min. low rate	Continuous mechanical supply and extract – min. high rate	Typically provided by opening windows

Table 4.2 ADF template systems

Overheating

Overheating is a serious concern within residential developments as there is currently no requirement for overheating prevention within the Building Regulations.

The ANC Guide to Acoustics, Ventilation and Overheating states the following with regards to overheating:

‘Developments will normally (but not always) require additional ventilation (above ADF whole dwelling ventilation provisions) in order to mitigate overheating. Where an overheating assessment is undertaken, it should provide details as to the duration and rate of any additional ventilation required to meet overheating compliance criteria. Where this additional ventilation is provided passively, the overheating assessment should also provide information about the required size of façade openings.’

It should be noted that the main differentiation between ventilation and overheating control is that the ventilation conditions prescribed by Approved Document F are applicable all of the time, whilst the overheating component applies only part of the time (to be defined by an overheating assessment for the scheme, if appropriate).

It is important to note that the recommended internal noise levels shown in Table 4.1 should be achieved whilst providing adequate ventilation (as outlined by Approved Document F), but the overheating condition should allow a relaxed standard internal sound environment, as follows:

‘...it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition’.

The rationale behind this is that the overheating condition would only apply for a relatively short period of time, and residential occupants would typically accept higher acoustic conditions internally whilst having control over thermal comfort within their property.

Table 4.3 below provides guidance for the assessment of the overheating condition.

Internal Ambient Noise Level		Examples of Outcomes	Risk Category
$L_{Aeq, T}$ during 07:00-23:00	$L_{Aeq, T}$ during 23:00-07:00		
≤35dB	≤30dB	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.	Negligible
> 35dB & ≤40dB	>30dB & ≤35dB	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 environment inside the dwelling such that there is a perceived change in the quality of life.	Low
> 40dB & ≤ 50dB	> 35dB & ≤ 43dB	Increasing risk of adverse effect due to impact on reliable speech communication during daytime or sleep disturbance at night. Although noise levels at the lower end of this category will cause changes in behaviour, they may still be considered suitable. Noise levels at the upper end of this category will result in more significant changes in behaviour and are only likely to be considered suitable if they occur for limited periods.	Medium
> 50dB	> 43dB	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.	High

Table 4.3 Guidance for assessment of noise from transportation noise sources relating to overheating condition (Ref: Table 3.3 of AVO Guide)

Please note that the ANC guide to acoustics, ventilation and overheating is currently a draft document, and is therefore used as a good practice document and not formal policy.

5.0 EXTERNAL BUILDING FABRIC SPECIFICATION

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed and non-glazed elements in order to achieve the recommended internal noise levels shown in Table 4.1, taking into account average and maximum noise levels monitored during the environmental noise survey.

Typical sized bedrooms with a high ratio of glazing to masonry have been used for all calculations in order to specify glazing.

As a more robust assessment, L_{Amax} spectrum values of night-time peaks have also been considered and incorporated into the glazing calculation in order to cater for the interior limit of 45 dB L_{Amax} for individual events, as recommended in WHO Guidelines.

Please note that the glazed and non-glazed element calculations would need to be finalised once all design proposals are finalised.

5.1 Non-Glazed Elements

It is understood that the non-glazed construction build-up would be as described within in Table 5.1 and would be expected to provide the minimum figures shown above when tested in accordance with BS EN ISO, 140-3:1995.

Element	Octave band centre frequency SRI, dB					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Internal lining of 12.5mm plasterboard, 25mm battens to create service void, 150mm timber frame fully filled with mineral wool, 18mm weatherboard/plywood, 50mm Kingspan phenolic insulation, 75mm battens, 12mm plywood, zinc cladding	32	40	46	50	51	55
Internal lining of 12.5mm plasterboard, 25mm battens to create service void, 150mm timber frame fully filled with mineral wool, 18mm weatherboard/plywood, 50mm Kingspan phenolic insulation, 25mm battens, slate tile (hanging)	38	45	51	55	55	55

Table 5.1 Assumed sound reduction performance for non-glazed elements

5.2 Glazed Elements

Minimum octave band sound reduction index (SRI) values required for all glazed elements to be installed are shown in Table 5.2. The performance is specified for the whole window unit, including the frame and other design features such as the inclusion of trickle vents. Sole glass performance data would not demonstrate compliance with this specification.

Glazing performance calculations have been based both on average measured night-time noise levels as well as verified against the L_{Amax} spectrum of individual events in order to comply with a maximum internal noise level of 45dB(A) in bedrooms as recommended by World Health Organisation Guidelines. The combined most robust results of these calculations are shown in Table 5.2.

Elevation	Octave band centre frequency SRI, dB						$R_w(C;C_{tr})$, dB
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
North	27	26	25	34	35	38	32 (-1;-3)
South	22	20	26	36	39	31	31 (-1;-4)

Table 5.2 Required glazing performance

The nominated glazing supplier should verify that their proposed window system meets the attenuation figures shown at each centre frequency band as shown in Table 5.2.

Example glazing types that would be expected achieve the above spectral values are shown in Table 5.3.

Elevation	Example glazing type
North Elevation	5/6/5mm
South Elevation	4/12/4mm

Table 5.3 Example glazing types

All major building elements should be tested in accordance with BS EN ISO 140-3:1995.

Independent testing at a UKAS accredited laboratory will be required in order to confirm the performance of the chosen system for an 'actual' configuration.

6.0 VENTILATION AND OVERHEATING

6.1 Ventilation Strategy

Based on the noise levels measured on site, appropriate ventilation systems are outlined in Table 6.1 below in order to ensure the internal noise environment is not compromised.

Ventilation System	Whole Dwelling Ventilation	Extract Ventilation
ADF System 1	Trickle vents providing a minimum performance of 36dB $D_{n,e,w}$ (North Elevation) and 27dB $D_{n,e,w}$ (South Elevation)	Intermittent extract fans
ADF System 3	Continuous mechanical extract (low rate) and trickle vents for supply providing a minimum performance of 36dB $D_{n,e,w}$ (North Elevation) and 27dB $D_{n,e,w}$ (South Elevation)	Continuous mechanical extract (high rate) with trickle vents providing inlet air
ADF System 4	Continuous mechanical supply and extract (low rate)	Continuous mechanical supply and extract (high rate)

Table 6.1 Ventilation systems

In the case of mechanical ventilation, systems should be designed to meet the internal noise levels as defined in CIBSE Guide A (2015), as shown in Table 6.2.

Room Type	LA_{eq} , dB	NR
Bedrooms	30	25
Living Rooms	35	30
Kitchen	45-50	40-45

Table 6.2 CIBSE Guide A 2015 guidance levels for mechanical building services

In all cases, purge ventilation would be provided by openable windows. As outlined in Section 4.3, the internal noise level requirement would not be applicable during purge conditions as this would only occur occasionally.

6.2 Overheating Control Strategy

In order to provide commentary with regards to the noise implications of the overheating strategy, thermal modelling calculations should be undertaken to inform the design team on the type of overheating strategy which should be adopted. The internal noise level would be dependent on the open area required to manage overheating, and the time that the element would be required to be open.

Based on the guidance in The ANC Guide to Acoustics, Ventilation and Overheating as outlined in Section 4.5, the development would fall into the following risk categories for the north and south elevations assuming a partially open window to control overheating.

Elevation	Day/ Night	Resultant Internal Level with Partially Open Window Providing 12dB Attenuation	Risk Category as per ANC Guidance
North Elevation	Day	47dB(A)	Medium
	Night	42dB(A)	Medium
South Elevation	Day	39dB(A)	Low
	Night	32dB(A)	Low

Table 6.3 Internal levels with partially open window

At present, accurate conclusions cannot be drawn as thermal modelling calculations are required to advise on the amount of time windows would need to be open, and the openable area which would be required.

As a guide, the following solutions could be implemented to control overheating:

Elevation	Mitigation Type	Description
North	Standard opening windows	Window(s) open sufficiently to provide a ventilation free-area equivalent to 2% of the floor area. Implementation of this strategy would result in the 'Medium' risk category. Therefore, the viability of this solution would depend on the amount of open area required and the time the opening is required to be open
	Attenuated vents/ louvres	Ventilation openings with means of attenuating sound. Typically acoustic louvres or acoustically lined ducts/ plena. Implementation of this strategy would result in the 'Negligible' risk category
	Mechanical Ventilation	Continuous mechanical supply and extract which can be designed to meet the overheating mitigation requirements. Implementation of this strategy would result in the 'Negligible' risk category
South	Standard opening windows	Window(s) open sufficiently to provide a ventilation free-area equivalent to 2% of the floor area. Implementation of this strategy would result in the 'Low' risk category.

Table 6.4 Potential overheating control solutions

It should be noted that overheating control is currently not covered under the Building Regulations, and therefore the implementation of any overheating strategy would be as good practice only. The systems outlined above would ensure a sustainable development in terms of future resident comfort and overheating mitigation.

7.0 EXTERNAL AMENITY AREA ASSESSMENT

External amenity spaces are proposed, as outlined in Figure 7.1 below.

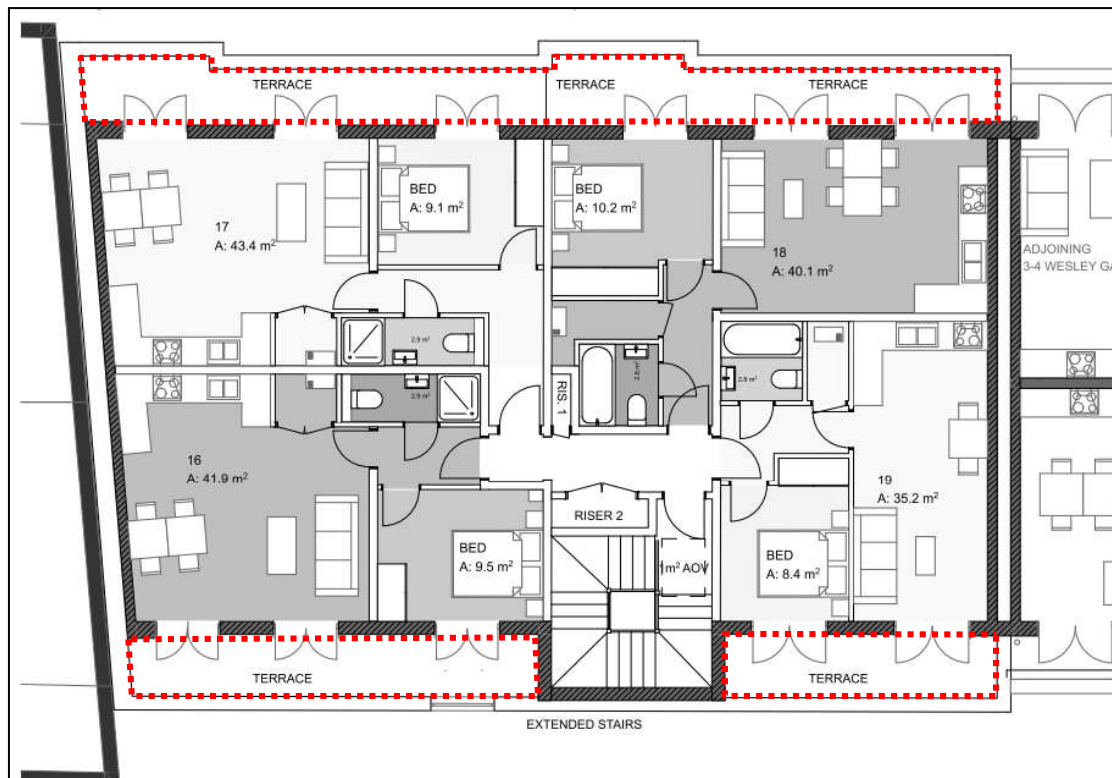


Figure 7.1 Floor plan with terraces outlined

Based on the levels calculated with the barrier provided by the parapet wall, noise levels on the terrace overlooking Queen's Road would be in the region of 54-59dB(A), from seated to standing position respectively.

As stated in BS8233:2014, '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.'

It is likely that when a resident would be utilising the space for prolonged periods they would be seated. As noise levels fall within the upper guideline value whilst in the seated position, we would deem the current noise profile appropriate for external amenity spaces.

Noise levels on the South facing elevation would be well within the recommended guideline values.

8.0 CONCLUSION

Environmental noise surveys have been undertaken at 1&2 Wesley Gate, Queens Road, Reading, RG1 4AP, allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

Measured noise levels allowed a robust glazing specification to be proposed which would provide internal noise levels for all residential environments of the development commensurate to the design range of BS8233.

Strategies for ventilation and overheating have been outlined in order to provide internal noise levels for all residential environments of the development commensurate to the design range of BS8233.

Noise levels within external amenity areas would be expected to meet the recommended levels provided within BS8233:2014.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

1&2 Wesley Gate, Queens Road, Reading
Environmental Noise Time History
From 31 October 2019 To 01 November 2019

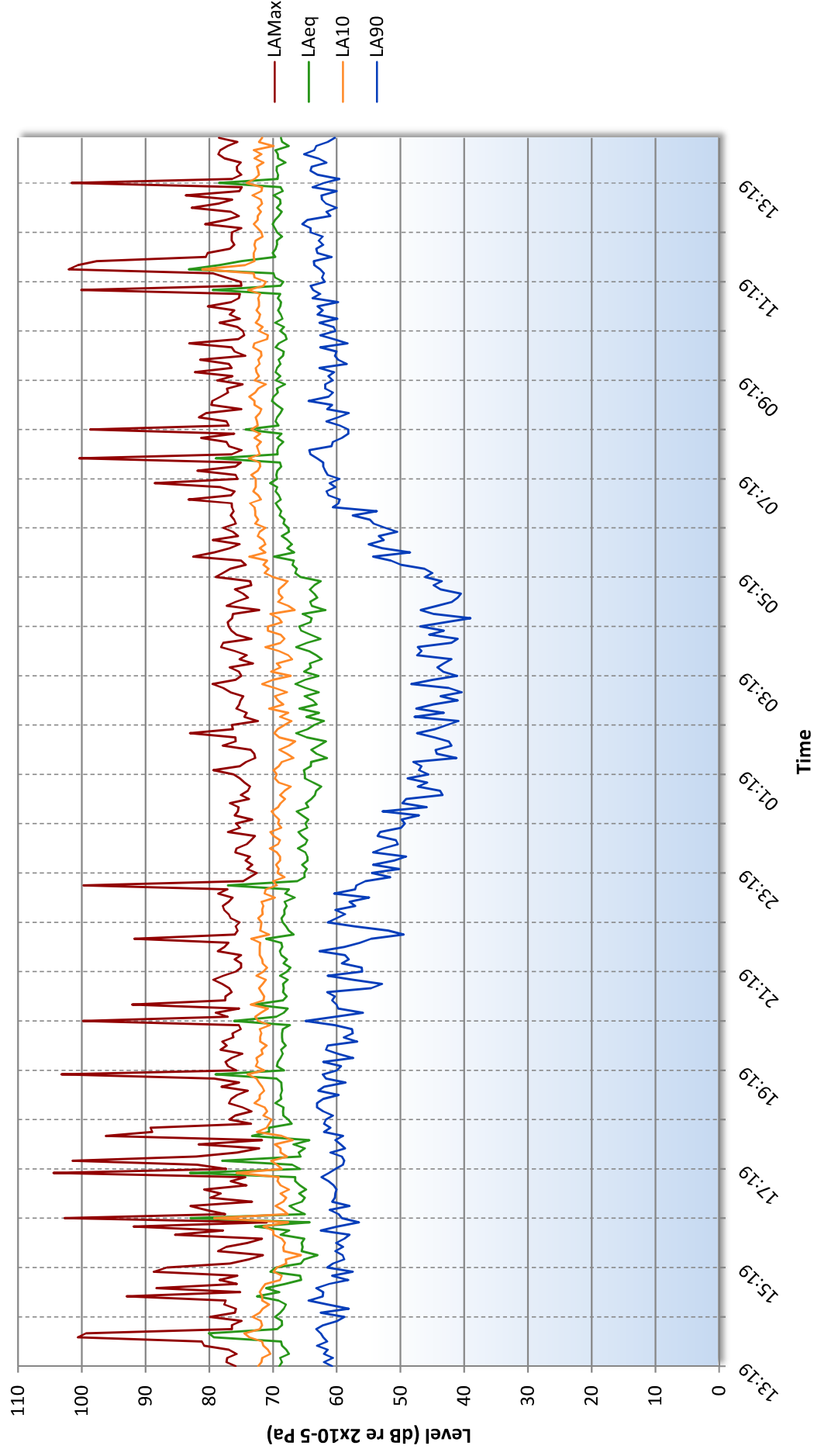


Figure 19617.TH1

1&2 Wesley Gate, Queens Road, Reading
Environmental Noise Time History
From 31 October 2019 To 01 November 2019

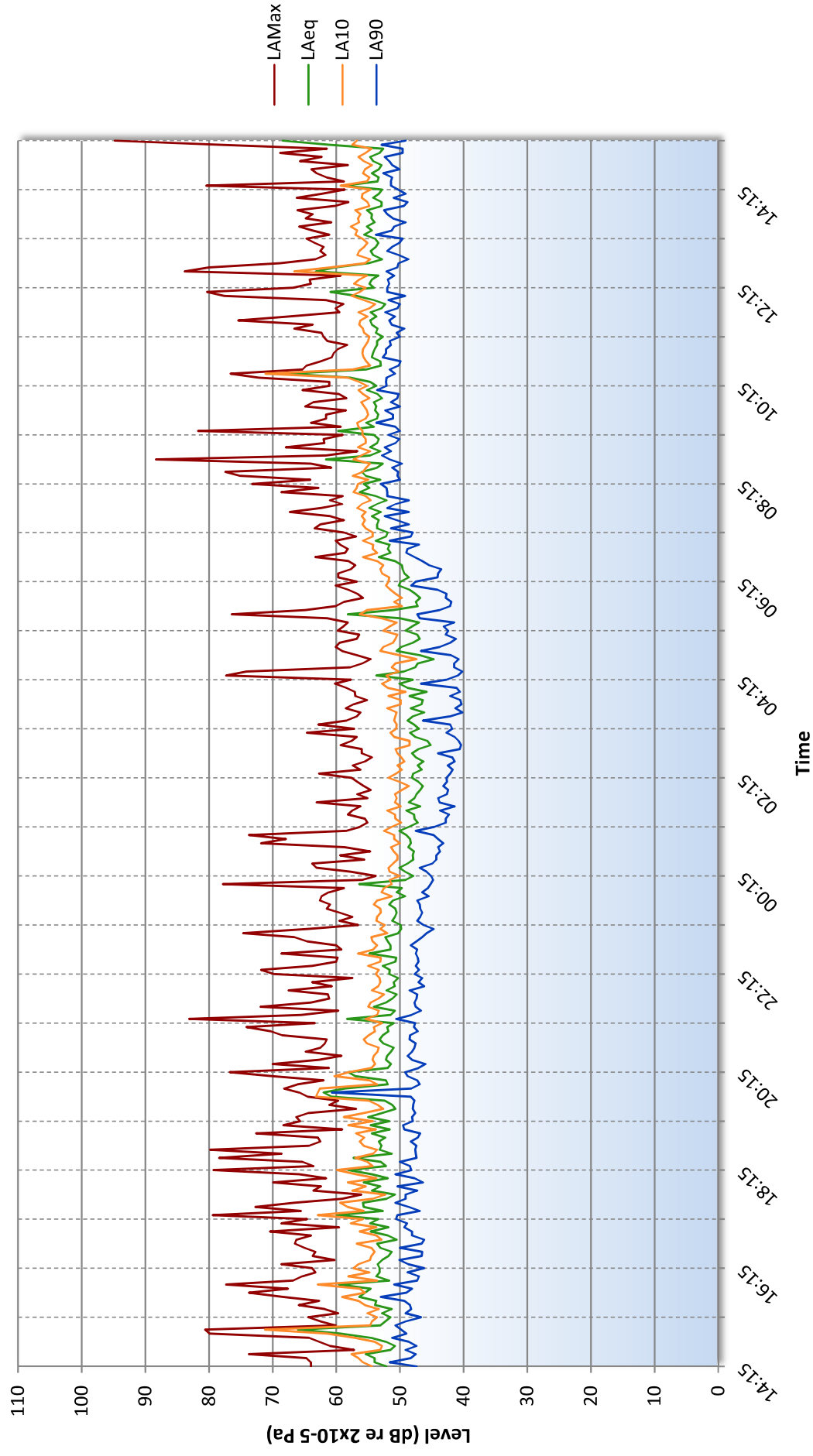


Figure 19617.TH2

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq} . The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.