Claredon House 59-75
Queens Road, Reading

APPROVAL OF DETAILS RESERVED BY CONDITION 21
22.03.2019

APPROVAL OF DETAILS RESERVED BY CONDITION 21

This statement has been prepared in support of an application seeking approval of details reserved by condition 21 of planning permission No. 180909

Condition 21:

No development shall take place until a detailed scheme, informed by an assessment of the current noise environment, for protecting the dwellings from the external noise environment of the area has been submitted to and approved, in writing, by the Local Planning Authority.

The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded. Thereafter, the development shall not be carried out other than in accordance with the approved scheme which shall be completed before any part of the accommodation hereby approved is occupied, unless the Local Planning Authority otherwise agrees in writing.

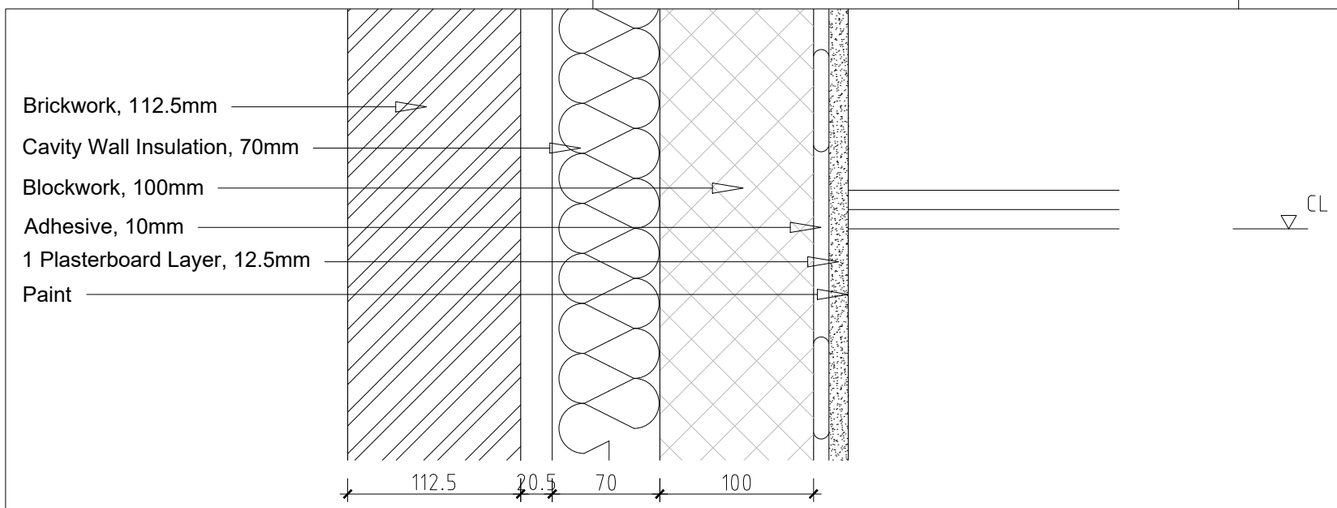
Reason: to protect the amenity of future occupants of the proposed development inaccordance with Policy CS34.

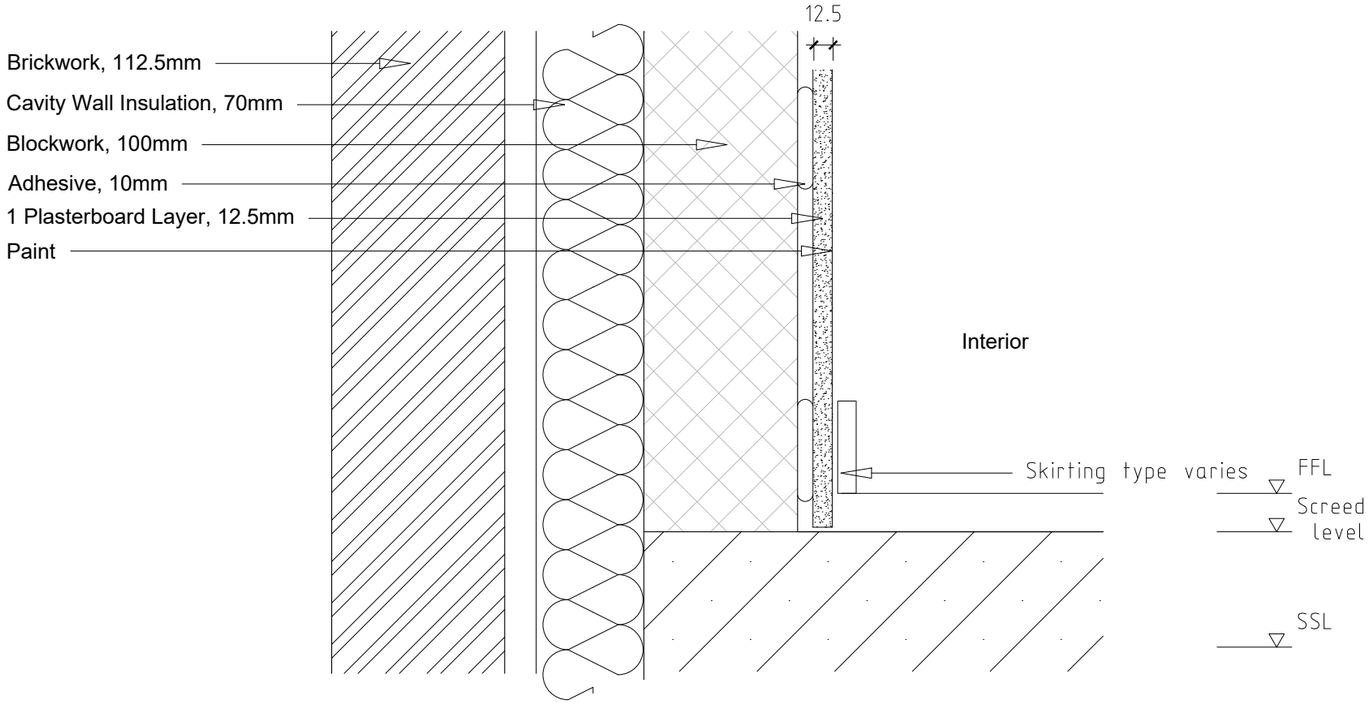
The development is designed and specified to meet the requirements from the *Finch Consulting Report. Environmental Noise and Impact Assessment at Royal Heights in Reading*, submitted at Planning Stage and presented in the Appendix.

Details of the building fabric are described in the drawings from the schedule below.

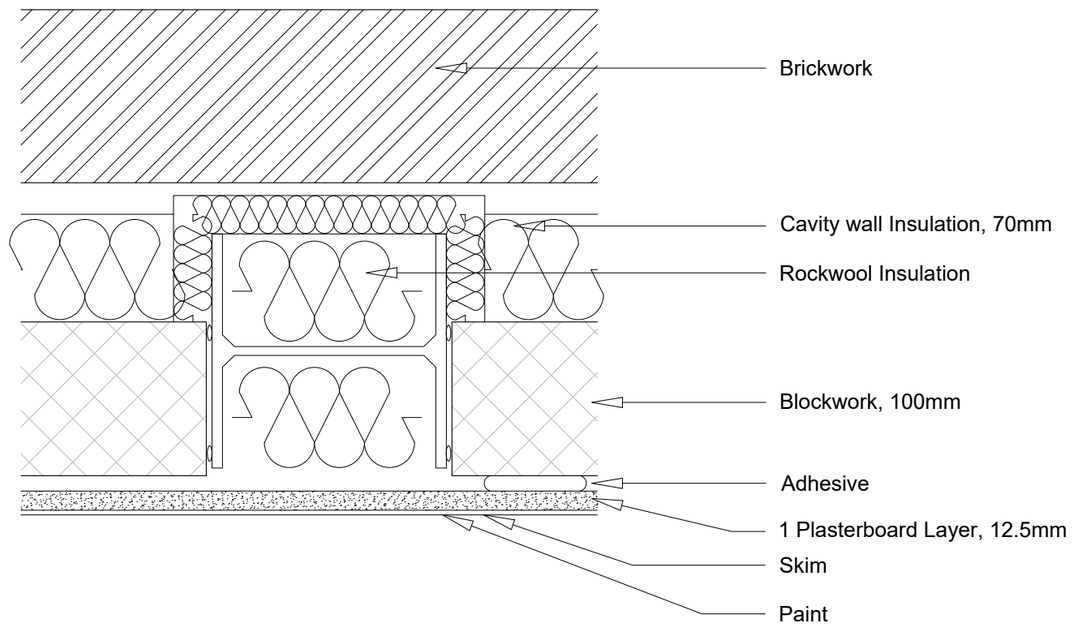
Drawing Schedule

Condition	Drawing Number	Drawing Title	Scale	Date	Revision	Comments
21	21-610	External Wall Details	1:2	02.04.19	00	
21	31-610	Typical Window Detail	1:15	02.04.19	00	

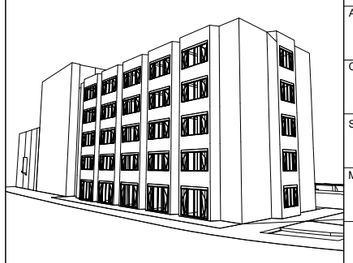




01 Base Section Detail - External Wall Build-up
1:5



02 Plan Detail - External Wall Build-up
1:5



Client:
Reading Heights Ltd
Unit G06, Clerkenwell Workshops
31 Clerkenwell Close, London EC1R 0AT
T +44 (0) 777 169 7927
mario@allieslondon.com

Architect:
Krause Architects
Unit A11, Jacks Place
6 Corbet Place, London E1 6NN
T +44 (0) 20 3397 1070
F +44 (0) 20 3397 1071
contact@krausearchitects.com

Cost Consultant:
Future 54, Elizabeth House,
39 York Road, London SE1 7N
T: +44 (0)20 7821 546
mark.wickenden@future54.com

Structural Engineer:
FLUID Structural Engineers
Second Floor 21 St Georges Road
London SE1 6ES
T: +44 (0) 20 7820 7766
paul@fluidstructures.com

M&E Engineer:
Mendick Waring Ltd
Edelman House, 1238 High Road
London N20 0LH
T +44 (0)208 446 9696
F +44 (0)208 446 9900
fergus@mendickwaring.co.uk

0 50 100 1:50

General Notes:

1. Please do not scale drawings, dimensions govern
2. All dimensions are in millimeters unless noted otherwise
3. All dimensions to be field verified before proceeding with work
4. Krause Architects should be notified of any discrepancies in writing
5. All areas are indicative and approximate only.
6. Contractor to survey site post strip out and to confirm layouts, setting out and details.

Rev.	Date	Reason For Issue	Chk
00	02.04.19	For Discharge of Condition	AK

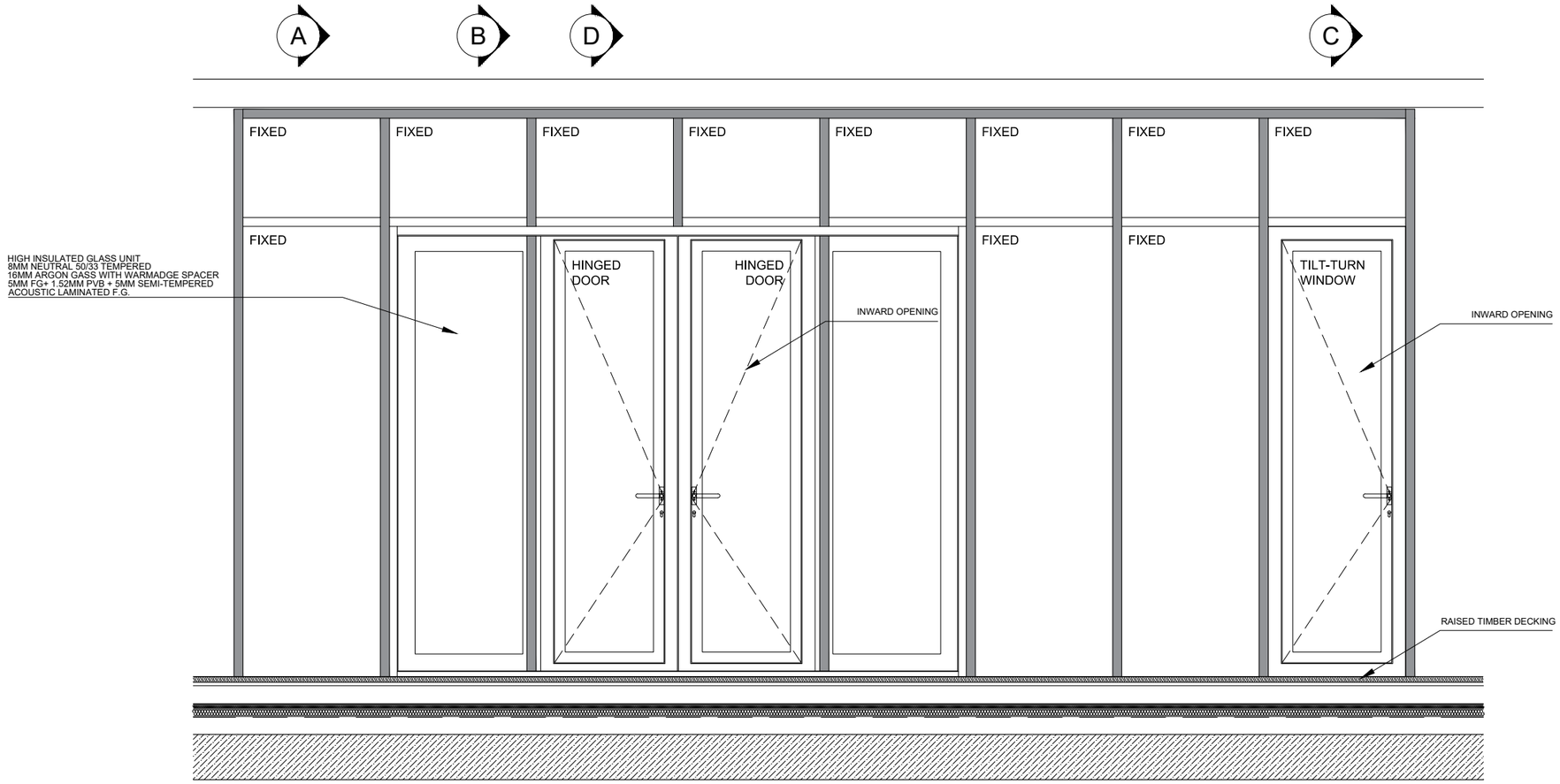
KRAUSE ARCHITECTS
Unit A11, Jacks Place, 6 Corbet Place, London E1 6NN
T +44 (0) 20 3397 1070
F +44 (0) 20 3397 1071
contact@krausearchitects.com

Project
Royal Heights - Reading
59-75 Queens Road, Reading RG1 4BN

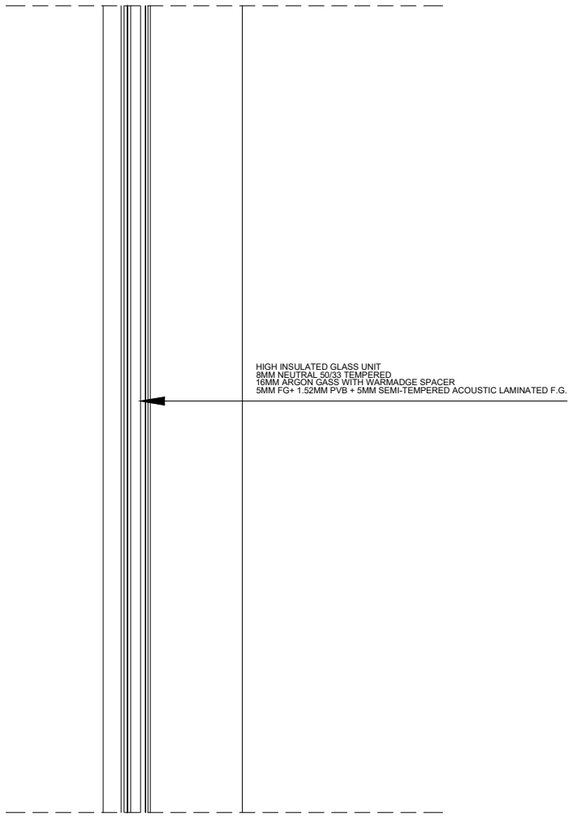
Title
External Wall Details

Project No.	Scale @ A1	Date	Drawn By
171101	1:2	02.04.19	AB

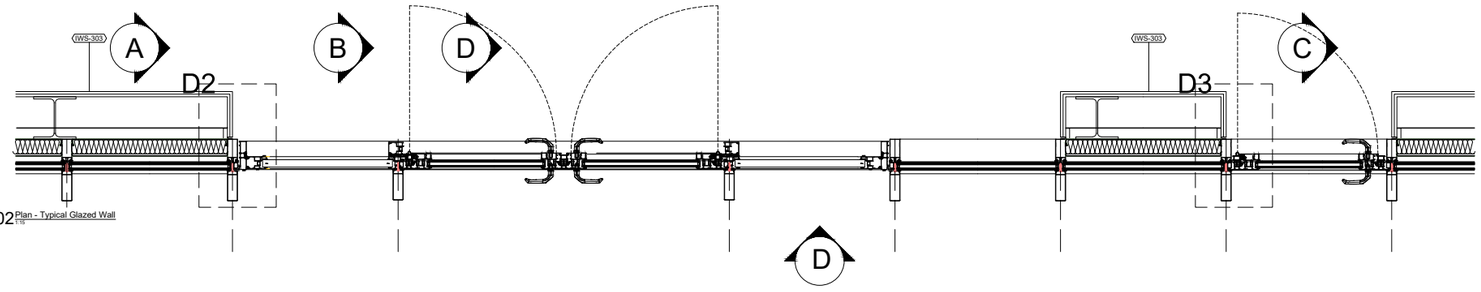
Number	Revision
21-610	00



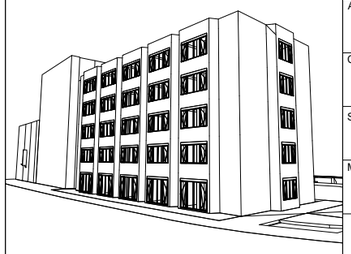
01 Elevation - Typical Glazed Wall
1:5



03 Section - Typical Glass
1:5



02 Plan - Typical Glazed Wall
1:5



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Unit G06, Clerkenwell Workshops
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Architect:
Krause Architects
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F +44 (0) 20 3397 1071
contact@krausearchitects.com

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Future 54, Elizabeth House,
39 York Road, London SE1 7N
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mark.wickenden@future54.com

Structural Engineer:
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Second Floor 21 St Georges Road
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T: +44 (0) 20 7820 7766
paul@fluidstructures.com

M&E Engineer:
Mendick Waring Ltd
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KRAUSE ARCHITECTS
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T +44 (0) 20 3397 1070
F +44 (0) 20 3397 1071
contact@krausearchitects.com

Project
Royal Heights - Reading
59-75 Queens Road, Reading RG1 4BN

Title
Typical Window Detail

Project No.	Scale @ A1	Date	Drawn By
171101	1:20	02.04.19	AB

Number	Revision
31-610	00

APPENDIX

Finch Consulting Report.

Environmental Noise and Impact Assessment at Royal Heights in Reading

Prepared for:

Allies Group
alper@allies.london
www.allies.london

Finch Consulting
Engineering Confidence.

Ivanhoe Business Park
Ashby de la Zouch
Leicestershire LE65 2AB
United Kingdom

enquiries@finch-consulting.com
+44 (0) 1530 412777

Report No: 182137

Date: First Edition April 2018,
Second Edition May 2018

DISTRIBUTION

Allies Group

Prepared by: T Chinelis, BSc(Hons) PgDip CEng MIOA MIMechE
Senior Consultant

Checked by: T Ward, BSc(Hons) MIOA
Principal Consultant

May 2018

TABLE OF CONTENTS

DISTRIBUTION 2

1.0 INTRODUCTION 6

2.0 SITE LOCATION 6

3.0 PLANNING POLICIES 9
Reading Borough Council 10

4.0 MEASUREMENT OF NOISE 13
Details of Environmental Sound Survey 13
Measurement Positions 13
Equipment 14
Weather Conditions 14
Results 15
Exterior Noise Levels 15
Extrium Noise Maps 16

5.0 ASSESSMENT LEVELS 18
Proposed LOAEL and SOAEL for Transportation Airborne Noise Affecting Rooms used for Residential Purposes 18

6.0 ASSESSMENT OF NOISE IMPACT 19
Indoor Levels 19
Impact at Most Affected Habitable Rooms 21
Impact at Habitable Rooms Partially Screened from Noise Traffic 22
Indoor Levels at Converted Office Accommodation 23
Outdoor Levels 23

7.0 CONCLUSIONS 24

APPENDIX 1 PLANNING POLICY AND GUIDANCE DOCUMENTS 26

APPENDIX 2 RESULTS OF NOISE SURVEY 42

APPENDIX 3 GLOSSARY 44

APPENDIX 4 ACOUSTIC SPECIFICATIONS 47

EXECUTIVE SUMMARY

An environmental noise survey at the proposed site was undertaken in order to review the existing incident noise levels at the proposed residential development.

The assessment of the suitability of the proposed residential extensions for their intended use was undertaken in full accordance with the aims and requirements within the National Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG). The NPPF is a material consideration for planning applications when the local plan does not align closely with its aims.

The assessment has demonstrated that the noise climate outside the proposed new habitable rooms will not give rise to significant adverse effects on health and quality of life. The assessment has demonstrated that based on the surrounding noise climate and provision of whole house background ventilation, compliance with the building regulations, without the need for enhancement measures, will result in suitable internal noise levels for habitable rooms with no direct line of sight to the surrounding road network. A number of “hot spot “locations may require the provision of an external fabric construction with an enhanced acoustic design which will be considered during the detailed design stage.

The review of the surrounding noise climate has shown that some of the balconies with a line of sight to surrounding roads may experience incident noise levels that may result in significant noise impacts. To mitigate some of this potential impact, recessed balconies have been proposed to floor one to five. Where projecting balconies are designed for other reasons between floors one to five, winter gardens (fully enclosed balconies) are proposed to mitigate potential noise impact.

The current proposals in relation to outdoor amenity overlooking the surrounding road network should therefore be weighted appropriately in the planning balance by the council’s planning officers in order to reach a sustainable and holistic solution.

1.0 INTRODUCTION

1.1 It is currently proposed to change the use of the office accommodation building called Clarendon House located at Queens Road, Reading into residential use. As part of the proposals, residential extensions to the building are also proposed. The scheme is currently called Royal Heights.

1.2 Under the Prior Approval scheme, a noise impact assessment in relation to the office conversion is not required to support the planning application since there will be no existing commercial uses near the development that can have a significant noise impact to the proposed new residential use and the dominant source of incident noise is surrounding road traffic.

1.3 However, the client has requested suggestions in relation to a suitable external building fabric construction to protect the future residential occupants of the converted premises.

1.4 This report presents the results of an environmental noise survey, a review of the suitability of the new residential extensions and acoustic specifications for the converted office accommodation.

1.5 To assist with the understanding of this report a brief glossary of acoustic terms can be found in Appendix 3. A more in-depth glossary of acoustic terms can be accessed at http://www.acoustic-glossary.co.uk.

2.0 SITE LOCATION

2.1 The site is located on Queens Road, in Reading, fronting the Inner Distribution Road with views towards the River Kennet. The site is located around 850m from Reading train station, which is to the north west.

2.2 Clarendon House is a prominent five storey office building providing 1,719m^2 of open plan space with some partitioned rooms. The site has approximately 24 surface level car parking spaces located at the rear. The site is 0.22 ha in size.

2.3 In the immediate context, the main use is residential, but in the wider area the main use in the area is office, with residential intermingled. There is a retail park to the north, and a church directly to the south.

2.4 The surrounding buildings vary in height from five to eleven storey office and residential blocks. The Blade to the north west of the site stands at 87m. Across the river, located to the north of the site is

King's Point, a residential building which is currently under construction and will be 17 storeys high when complete.

2.5 Clarendon House is a 1980s five storey purpose built office block. The building is constructed of a concrete frame with brick cladding. The facade comprises glazing in a grid format, these windows have light aluminium sills with dark aluminium frames. The building also has arched brick details at ground floor above the large bay windows.

2.6 The location of Clarendon House is shown in Figure 1 below.

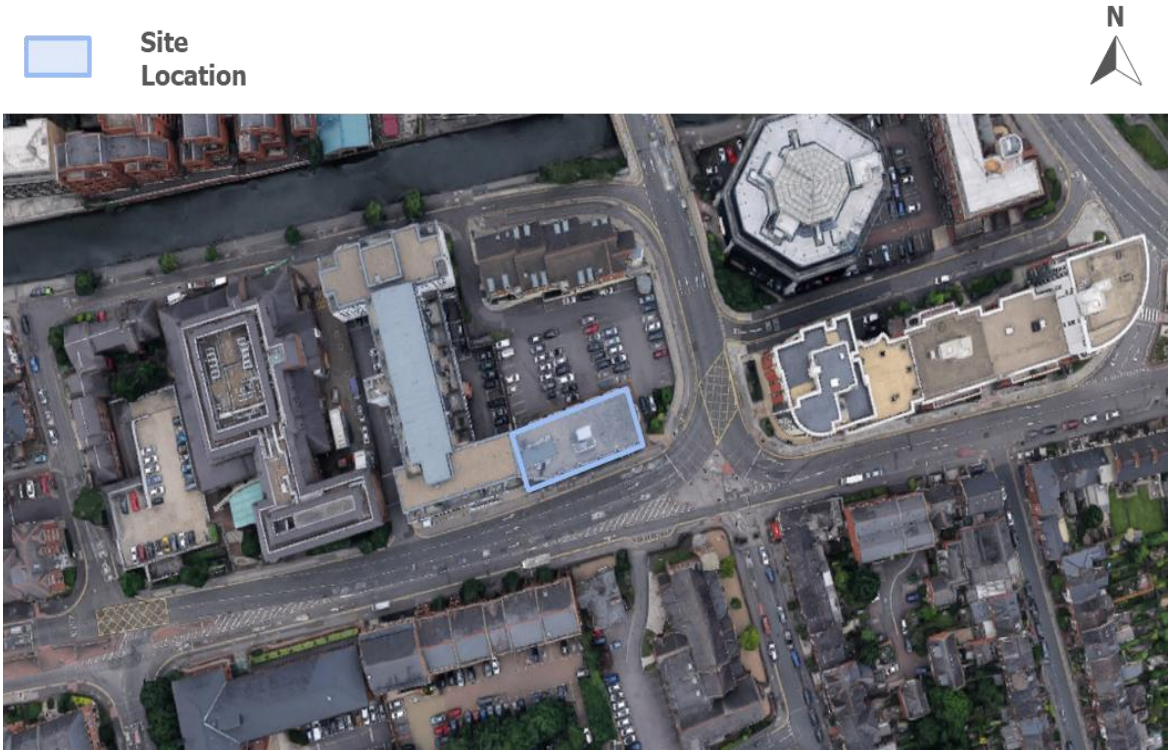


Figure 1: Site Location Map

2.7 Figure 2 below shows the proposed ground floor arrangement of the development. The proposals allow for the erection of a one roof storey extension, a part six, part ten storey building and mews houses comprising 4108 sqm (GEA) of new development, providing up to 50 residential units together with associated services enclosures, parking and landscaping.

Figure 2: Ground Floor Layout of Development Showing Proposed Extensions

2.8 Figure 3 below shows the proposed south elevation of the development where the proposed extension to the east is clearly shown.

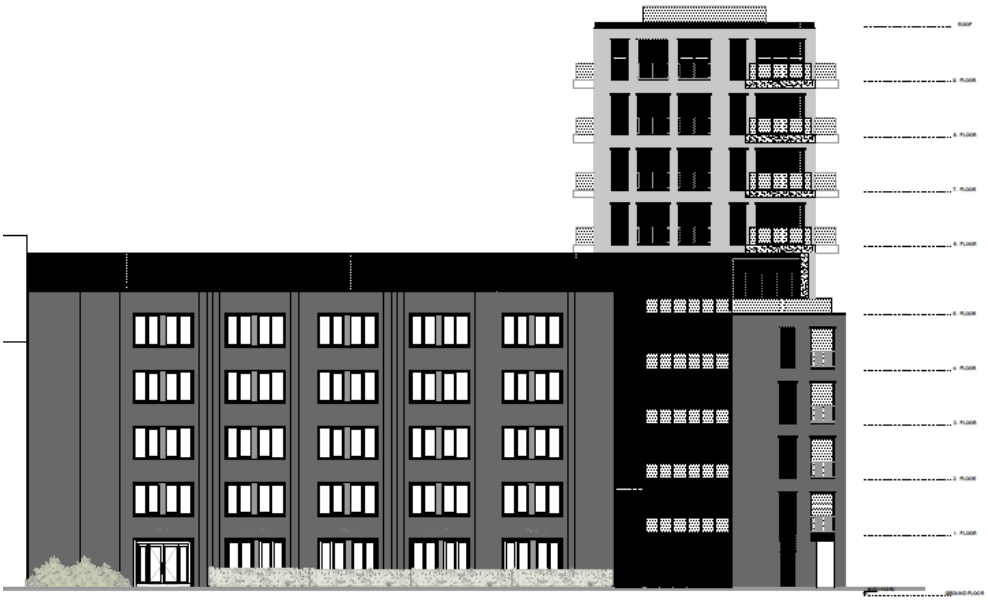


Figure 3: South Elevation of Development

3.0 PLANNING POLICIES

3.1 A great deal of change has occurred in recent years in the assessment of noise impacts and their relationship with planning decisions. In 2010 the publication of the Noise Policy Statement for England (NPSE) introduced clear aims in relation to the management of noise via government policy. It introduced new assessment terms like LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level) and provided the government vision for the control of noise impacts.

3.2 In 2012 the National Planning Policy Framework (NPPF) was published that replaced previous guidance (the PPG24) and reiterated the aims in the NPSE. It set a requirement for local authorities to update their local plans in order to show alignment with the aims of the NPPF and importantly if such an alignment is not evident, planning decisions should view the NPPF as a material consideration and therefore place more weight to an NPPF compliant assessment. The NPSE or the NPPF do not contain technical guidance for the assessment of noise through the planning system. No British Standards or any documents are quoted therein as suitable for the assessment of noise. In March 2014, the Planning Practice Guidance was published that constituted technical guidance for the application of the NPPF. However, it too did not contain any objective levels to base an assessment of noise impacts.

3.3 In order to undertake an assessment relating to environmental noise, the assessor now has to propose suitable (in his or her professional opinion) values for the LOAEL and SOAEL based on guidance documents, research, standards etc. and these values may be unique to each project and may be different for different sources and even different time periods.

3.4 In a nutshell, if the impact is below the LOAEL, planning permission ought to be granted without any conditions. If the impact is above the SOAEL, planning permission may be refused if suitable mitigation measures are not available or when other sustainability targets are not met. When the impact is predicted to lie between the LOAEL and SOAEL, planning permission ought to be granted with a suitable planning condition to ensure that the impact is reduced as far as reasonably practicable when the development reaches the detailed design stage and the proposals develop further.

3.5 It ought to be highlighted that noise impact assessments undertaken to support the planning application can only offer an outline of a design for any mitigation measures and these will always be discretional at this stage of the development.

3.6 Appendix 1 presents the relevant planning policies on a national level, as well as the guidance documents that will be used in order to propose suitable LOAEL and SOAEL values for the assessment of the relevant impacts. These values will be presented within the body of this report but the background to these is available in Appendix 1.

3.7 It should be highlighted that this report is mainly addressed to the local planning authority (the planning officer(s)) and offers an NPPF-compliant assessment to highlight the proper planning decisions for the planning application related to the proposed new residential premises. The conversion of Clarendon House into 49 self-contained apartments were previously consented under a Permitted Development process and a noise impact assessment is not required since the scheme is only subject to road traffic noise. The internal building fabric will however be designed to comply with the building regulations and the developer has requested an assessment of the external building fabric for design development purposes (and this is presented within this report).

3.8 Even though the NPPF is a material consideration (and therefore can override decisions made via adherence to a non-compliant local plan), the level of correlation with local policies should be reviewed in noise impact assessment reports (prepared to assist planning applications) to present a thorough overview of the applicable planning law. Relevant local policies are presented in the following sections.

Reading Borough Council

3.9 Reading Borough Council is working on producing a new Local Plan, which will replace the current development plans (the Core Strategy, Reading Central Area Action Plan and Sites and Detailed Policies Document) with a new plan setting out how Reading will develop up to 2036.

Core Strategy

3.10 Reading Borough Council's Core Strategy sets out the council's overall planning strategy and important principles for development in Reading. It was adopted in January 2008 and altered in January 2015.

3.11 Noise is included within Policy CS34 where it is stated that

"*Pollution and Water Resources Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development. Proposals*

for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution. Development will be permitted on land affected by contamination where it can be demonstrated, to the satisfaction of the LPA, that the contamination can be satisfactorily remediated so that it is suitable for the proposed end use".

Reading Central Area Action Plan

3.12 Reading Borough Council's Central Area Action Plan Core Strategy sets out the council's planning principles for the centre of Reading up until 2026. It contains general policies and details on specific sites it aims to develop and protect.

3.13 In Paragraph 7.6 it states that

"*in some cases, residential development is proposed in areas where noise levels may be an issue. It should be possible to mitigate this through the design of the scheme. In order for the internal noise levels to be reasonable and not adversely affect health, it would be necessary to provide a system of ventilation that entirely removes the necessity to open windows, even in very hot weather. Similarly, in terms of air quality, mitigation of impacts on residential development may be required, including means of ventilation that remove the need to open windows, and draw in the lowest levels of pollution possible, for instance from roof sources. This should be secured through the design of the proposal, and planning condition if necessary. Such systems will require additional energy use, which will need to be offset in order to comply with policy CS1 of the Core Strategy.*"

3.14 Policy RC9 *Living in the Centre* states that

"*Proposals for residential development within the central area will be assessed against the following criteria…ii Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated*".

Sites and Detailed Policies

3.15 Reading Borough Council's *Sites and Detailed Policies* document sets out detailed policies it uses when considering planning applications and identifies sites for development and protection.

3.16 Policy DM8: RESIDENTIAL CONVERSIONS states that

"*Proposals to convert properties into self-contained flats or for multiple occupation under Core Strategy Policy CS18 will only be acceptable where:*

- *The proposal respects the physical character of the area and additionally would not, either individually or cumulatively, unduly dilute or harm an existing mixed and sustainable community through the significant loss of single family housing;*
- *There are no unacceptable adverse impacts to other residential properties arising from noise and disturbance in terms of the number and layout of units proposed and the proximity to other properties;*
- *There is appropriate sound insulation between proposed and neighboring units and layouts avoid inappropriate stacking and location of rooms between units.*"

3.17 Paragraph 5.4.8 states that

"*Generally, conversions provide for a market need for small, flexibly let accommodation reflecting household formation trends in the population and the more transient nature of parts of the labour market. However, there has been a substantial increase in applications for conversions over recent years as well as evidence of large numbers of unauthorised conversions. It is clear that significant effects on the character of an area or street are being experienced in several parts of Reading where large numbers of conversions are taking place. Such streets are suffering. When calculating the floor area of a property the measurement should be based on the external dimensions as at 1st July 1948 or when built (which ever is the later) from impacts such as significant car parking problems including parking abuse; clutter and untidiness; a plethora of satellite dishes; poor building maintenance; increased activity, noise and nuisance, etc. The quality of conversions, particularly where unregulated, can also be poor, with poor standards of accommodation and health and safety fears*".

NPPF Compliance

3.18 Reading Borough Council's Policies CS34, RC9 and DM8 that refer to noise impacts do not use the same wording as Paragraph 123 of the NPPF and the level of convergence may be debatable. These policies do not provide an assessment methodology that can be used to demonstrate NPPF compliance and therefore the guidance in the NPPF and PPG should be used for such an assessment to be undertaken.

3.19 As neither the NPPF nor Policies CS34, RC9 and DM8 provide specific objective criteria for the assessment of noise, it is important to review relevant guidance in order to propose objective levels which can be used to assess a proposal in line with the aims of the NPPF (which is a material consideration for planning application), and this guidance is presented in Appendix 1.

4.0 MEASUREMENT OF NOISE

Details of Environmental Sound Survey

4.1 Two sound level meters were installed on site from Thursday 11 January 2018 to Friday 12 January 2018.

4.2 The sound level meters were programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices and corresponding octave band frequency information (for L_{eq}) for fifteen-minute sample periods.

Measurement Positions

4.3 The measurements of incident sound pressure levels were undertaken at two locations. The approximate locations of the microphones are indicated in Figure 4 below. At Position 1, the microphone was located outside a second-floor window at the eastern end of the south elevation overlooking Watlington Street/Queens road. At Position 2 the microphone was located outside a second-floor window approximately at the middle of the northern elevation of Clarendon House. The two measurement positions were not in free field conditions and therefore 3 dB has been subtracted from the recorded measurements.

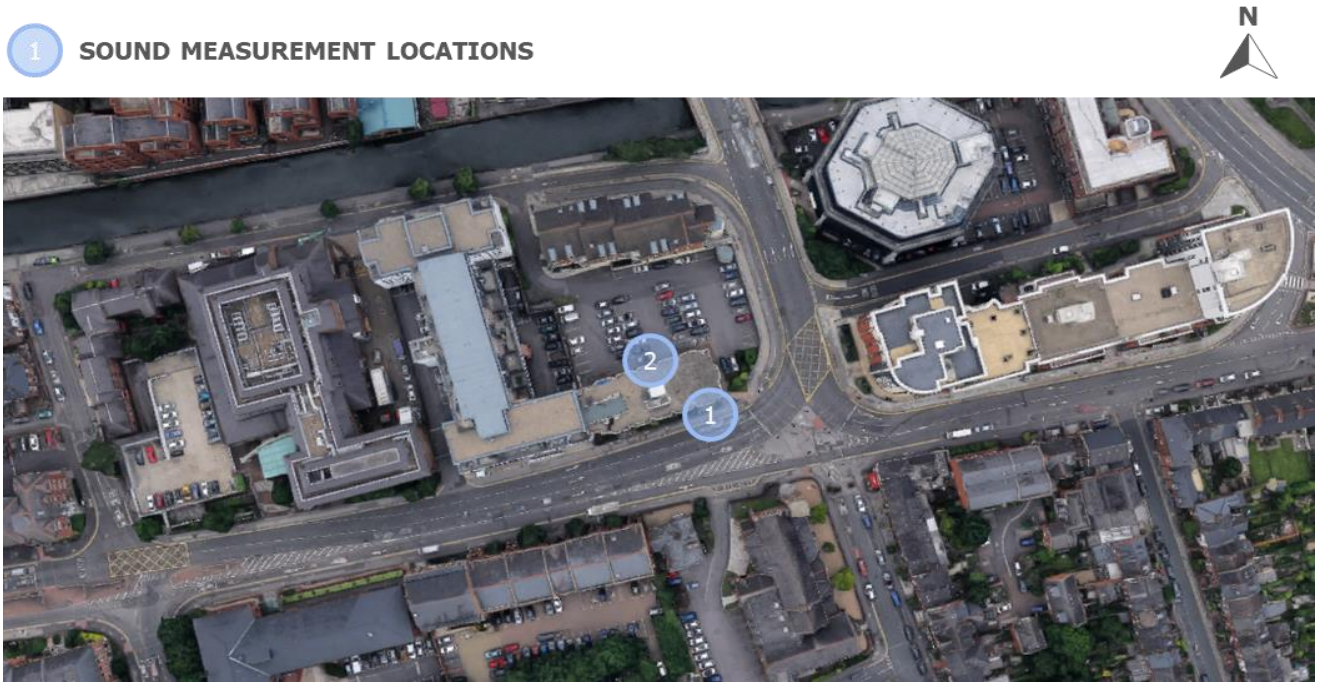


Figure 4: On Site Sound Pressure Level Measurement Positions

Equipment

4.4 Details of the equipment used during the survey are provided in Table 1 below. The sound level meters were subjected to sensitivity checks (or a 'field calibration') before and after the survey; no significant changes (+/-0.2 dB) in the levels were noted.

Position	Description	Model / serial no.	Calibration date	Calibration certificate no.
1	Class 1 Sound level meter	Norsonic SLM 1406112	14/11/2016	423094
	Condenser microphone	Norsonic 1127/151737		
	Preamplifier	Norsonic 1209/20299		
	Calibrator	B & K 4231/1839133	20/11/2017	427132
2	Class 1 Sound level meter	Norsonic SLM 140/1403413	16/01/2017	424457
	Condenser microphone	Norsonic 40AF/207390		
	Preamplifier	Norsonic 1209/12821		
	Calibrator	B & K 4231/1839133	20/11/2017	427132

Table 1: On Site Instrumentation

Weather Conditions

4.5 Weather conditions were determined when the sound level meters were set up and when they were collected. It is considered that the meteorological conditions were appropriate for environmental noise measurements. Table 2 below presents the weather conditions recorded on site.

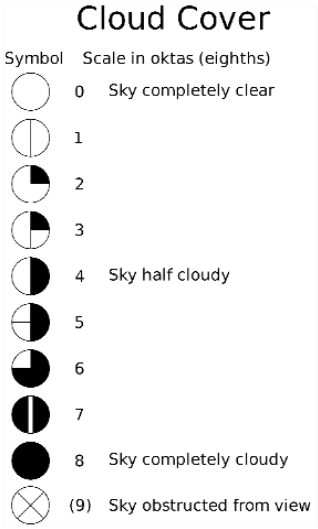
Date/Time	Description	Setting up of sound level meters	Collection of sound level meters
11/01/2018 – 12/01/2018	Temperature (C)	6	7
	Precipitation:	0	0
	Cloud cover (oktas - see guide)	8	8
	Presence of fog/snow/ice	Misty	Misty
	Presence of damp roads/wet ground	Slightly damp	Slightly damp
	Wind Speed (m/s)	<1	<1
	Wind Direction	Could not identify	Could not identify
	Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Table 2: Weather Conditions

Results

4.6 At the beginning and end of the survey, the dominant source of noise around the site was road traffic.

Exterior Noise Levels

4.7 The single figure free field equivalent noise levels are presented in time history graphs in Appendix 2. The relevant results of the survey have been summarised in Table 3 below.

Position	Measurement period	Range of recorded sound pressure levels (dB)			
		L_{Aeq} (15 minutes)	L_{Amax} (15 minutes)	L_{A10} (15 minutes)	L_{A90} (15 minutes)
1	Daytime (07.00 – 23.00 hours)	65-76	74-106	69-72	54-64
	Night-time (23.00 – 07.00 hours)	57-72	70-98	61-71	35-61
2	Daytime (07.00 – 23.00 hours)	57-70	65-93	59-67	47-57
	Night-time (23.00 – 07.00 hours)	48-66	60-89	52-62	36-52

Table 3: Summary of Survey Results (free field levels)

4.0 Table 4 below presents the incident free field noise levels at the measurement position in terms of daytime (16 hours) and night-time (8 hours) levels measured during the monitoring periods.

Position	Free field sound pressure levels (dB)	Free field sound pressure levels (dB)
	***L*Aeq (16 hours)**	***L*Aeq (8 hours)**
1	70	63
2	62	55

Table 4: Daytime and Night-Time Equivalent Levels (Free Field Levels)

4.1 Table 5 below presents the suggested incident noise levels that can be used for the assessment of environmental noise break in (the spectrum data are taken from the results of the onsite survey).

Position /Period	Incident free field sound pressure levels (dB) at Octave Band Centre Frequencies (Hz)								A-weighted level (dB)
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
1/Daytime	74	66	63	62	67	65	56	50	70
1/Night-time	67	59	56	56	60	57	48	45	63
2/Daytime	67	60	58	56	58	55	48	40	62
2/Night-time	62	53	51	49	52	49	40	32	55

Table 5: Free Field Equivalent Facade Incident Environmental Noise Levels at Octave Band Centre Frequencies.

Extrium Noise Maps

4.2 The noise maps produced by Extrium[1] present noise emissions due to road traffic alone at the site. The screen shots below present the predicted road traffic noise levels around the current site based on the results of the noise modelling by Extrium.

[1] Extrium is a specialist environmental and geospatial consultancy supporting Defra in producing Noise Maps

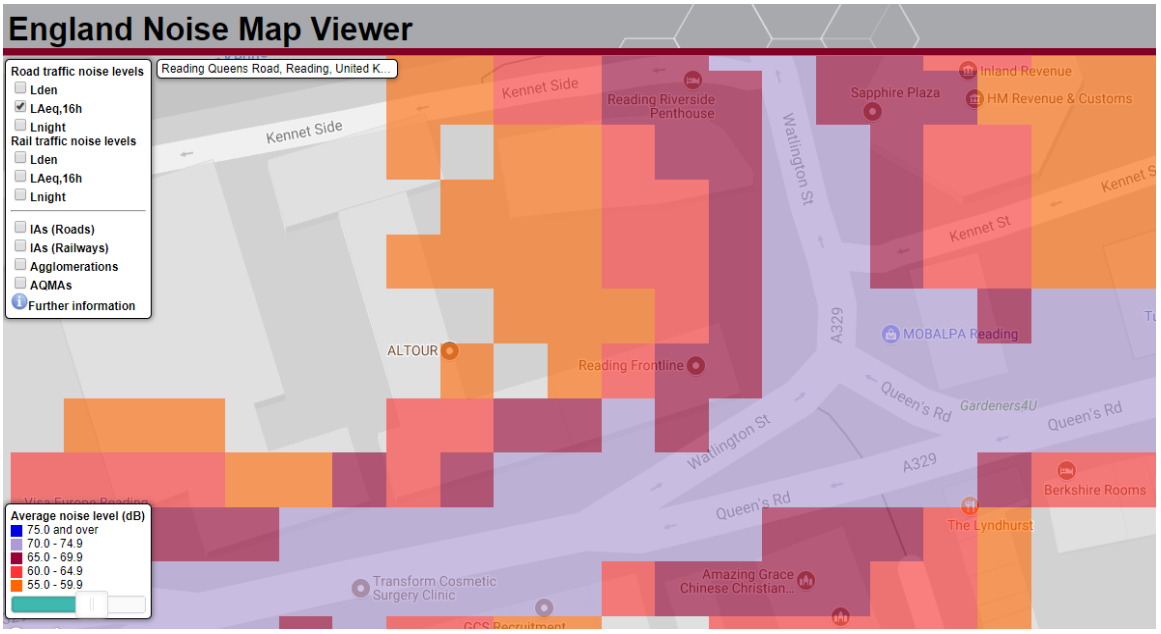


Figure 5: Road Noise Modelling. Daytime levels

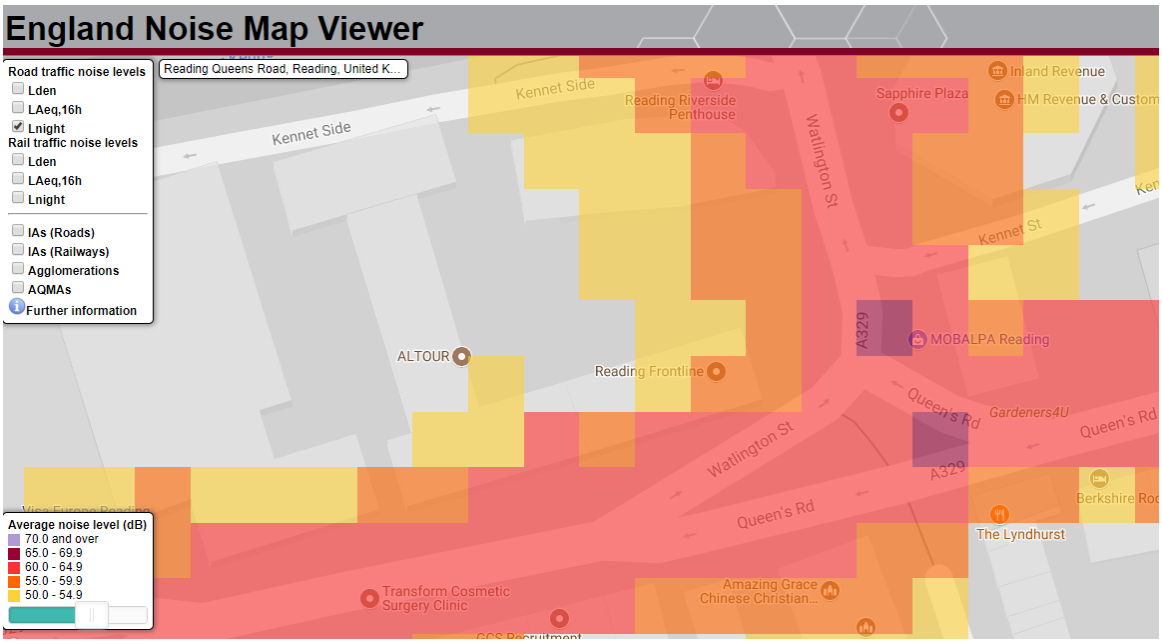


Figure 6: Road Noise Modelling. Night-Time Noise Levels

4.8 Table 6 below compares the results of the survey at Position 1 and computer noise modelling.

Position	Sound Pressure Levels (dB)	
	L_{Aeq} (16 hours)	L_{Aeq} (8 hours)
Based on sound pressure level measurements	70	63
Based on Extrium's predictions	65-69.9	60-64.9

Table 6: Comparison Between Recorded Sound Pressure Levels and Results of Road Traffic Noise Modelling.

4.9 Based on the information in Table 6 there is a great deal of correlation between the results of the survey and the computer modelling. However, the noise levels at the 'worst case' locations at the site would be at the new corner of the development overlooking the junction of the two streets to the south and east and should be outside facades belonging to the proposed new extension to the east of Clarendon House.

5.0 ASSESSMENT LEVELS

5.1 The applicable policy and guidance documents are presented in Appendix 1. This section shows the proposed LOAEL and SOAEL values that will be used in the assessment in relation to the proposed new residential extensions to Clarendon House.

Proposed LOAEL and SOAEL for Transportation Airborne Noise Affecting Rooms used for Residential Purposes

5.2 The proposed LOAEL and SOAEL values in relation to transportation airborne noise affecting rooms used for residential premises are provided in Table 7 below. It should be highlighted that the Secretary of State's approved assessment methodology for the HS2 project includes an outdoor SOAEL of 65 dB $L_{Aeq,16h}$. The HS2 project also includes an outdoor LOAEL of 50 dB $L_{Aeq,16h}$. Therefore, the difference between the LOAEL and SOAEL for transportation noise in the Secretary of State's approved HS2's environmental statement is 15 dB.

Level	Daytime (07:00 hours to 23:00 hours)	Night-Time (23:00 hours to 07:00 hours)
LOAEL Internal	35 $L_{Aeq,16h}$ (dB)	30 $L_{Aeq,8h}$ (dB)
SOAEL Internal	49 $L_{Aeq,16h}$ (dB)	44 $L_{Aeq,8h}$ (dB)
LOAEL External	50 $L_{Aeq,16h}$ (dB)	Not Applicable
SOAEL External	65 $L_{Aeq,16h}$ (dB)	Not Applicable

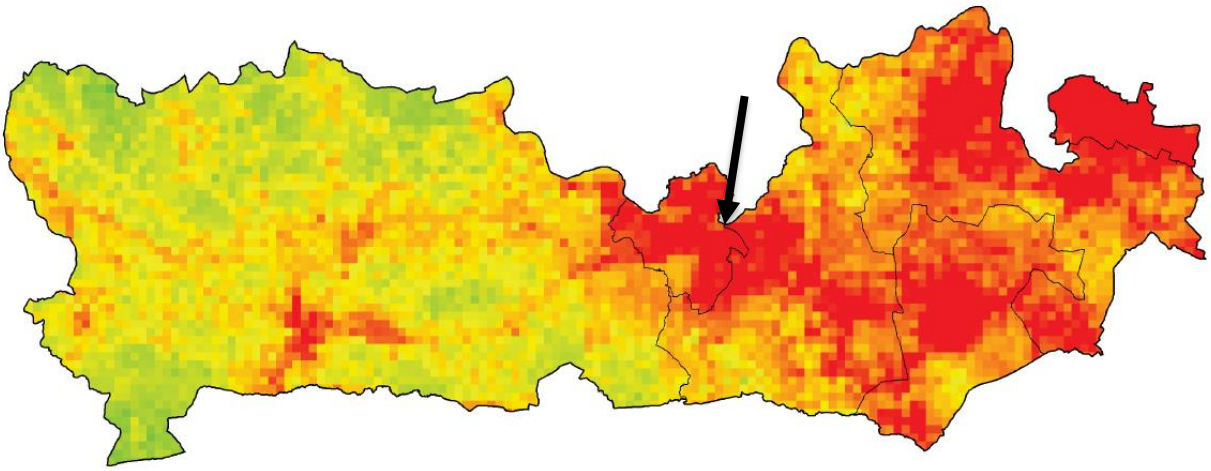
Table 7: Proposed LOAEL and SOAEL for Transportation Noise Affecting New Dwellings

5.3 The LOAEL and SOAEL values above are related to the first two aims in Paragraph 123 of the NPPF.

5.4 The proposed new use of the site contains noise sensitive uses. Based on the site inspection we could not identify any nearby commercial businesses that could be affected by this use. Therefore, the third aim (third bullet point) of Paragraph 123 of the NPPF does not apply for the determination of the planning decision.

5.5 In relation to the fourth aim (fourth bullet point in Paragraph 123) in the NPPF, regarding the protection of tranquil areas, advice was sought from the Campaign to Protect Rural England. This organisation has published maps that use colours to indicate tranquillity across the country. Areas of red or reddish colour have a low level of tranquillity and areas of green colour have a high level of tranquillity. The figure below of this map for Berkshire shows that the location of the site has a low value of tranquillity and therefore it is assumed that the fourth aim of Paragraph 123 does not carry any weight in the planning decision for the proposals.

Berkshire



6.0 ASSESSMENT OF NOISE IMPACT

Indoor Levels

6.1 In order to assess the site in relation to the applicable policy aims, it is important to review the internal noise levels due to incident noise ingress inside the proposed habitable rooms.

6.2 The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes, etc.).

6.3 Due to the layout, orientation, size, location and varying noise climate around the development it can be inferred that each façade and probably each window and ventilator (if present) on a façade should have a different sound insulation performance level in order for a specific internal ambient noise level to be reached. Logistically, this could result in increased costs for the development due to bespoke solutions, effects on programme and increase of errors during construction. National policy on noise does not insist on compliance with a specific level but rather it suggests that reasonably practicable

mitigation measures should be put in place in order to approach a certain target level (assuming the non-mitigated impact is predicted to lie above this target level) when this level is below the SOAEL.

6.4 Therefore, it is not practical to specify a large number of different external building fabric constructions and this is also not supported by national policy on noise. It should be highlighted that, assuming there are no specific requirements for the acoustic performance of individual elements that make up the external building fabric, compliance with the building regulations would imply the use of double glazed thermal glazing and trickle ventilators of the hit and miss type as a minimum (in relation to sound insulation). Therefore, compliance with the building regulations already implies a certain level of sound insulation from external noise that was not historically present (i.e. when partially open windows were considered an acceptable measure to provide background or primary ventilation into dwellings).

6.5 Incident traffic noise levels around the development will differ substantially by direction. Based on the results of the noise survey, the computer modelling and professional experience it appears that the facades that overlook Watlington Street will experience daytime noise levels in the high 60s to low 70s dB, the facades on the top levels of the extension that do not overlook Watlington Street will experience incident daytime noise levels in the low to mid 60s dB, whereas the facades to the rear of the site and below the height of the existing Clarendon House, will be substantially screened from road traffic noise and therefore should experience incident daytime noise levels in the high 40s to mid 50s dB.

6.6 The latest set of drawings for the development are dated 11 January 2018.

6.7 The results of the noise survey have showed that the daytime impact is the ‘worst case’. The detailed calculation methodology described in BS8233:2014 will be used in the assessment as detailed in the British Standard.

6.8 Table 8 below presents the input data[2] used to predict the resultant daytime internal noise level in typical ‘worst case’ rooms facing south or east at the extension to the east of Clarendon house.

[2] Approximate values

Bedroom Level 0	
Room Volume (m^3)	46
Room Type	A typical bedroom
Room Furnishings	Curtains, bed, timber floor finish
Area of window (m^2)	4.5
Area of wall (m^2)	18
Effective area of ventilator (mm^2)	MVHR System 4, whole house ventilation
Living Room Levels 1-5 (south facing living room)	
Room Volume (m^3)	50
Room Type	living room/dining room south elevation
Room Furnishings	Sofa, small rug, blinds, timber floor finish
Area of window (m^2)	16
Area of wall (m^2)	2
Effective area of ventilator (mm^2)	MVHR System 4, whole house ventilation
Small bedroom Levels 6-9 (south facing small bedroom)	
Room Volume (m^3)	17
Room Type	Small Bedroom
Room Furnishings	Curtains, bed, timber floor finish
Area of window (m^2)	4
Area of wall (m^2)	3
Effective area of ventilator (mm^2)	MVHR System 4, whole house ventilation

Table 8: Room Information Required for the Noise Break in Assessment.

6.9 It should be noted that even though Level 5 of the extension contains a bedroom overlooking to the east with a fully glazed façade, road traffic noise screening due to the terrace outside this room results in this room not being the most affected by road noise on this Level.

Impact at Most Affected Habitable Rooms

6.10 The input data presented in the preceding sections were used in spreadsheet models realising the calculation methodology described in BS 8233:2014 in order to calculate the internal daytime ambient noise level. The calculation showed that L_{Aeq} levels below 35 dB (and therefore below the preferred guideline level for bedrooms/living rooms in Table 4 of BS8233:2014) are achievable by whole house ventilation (as is currently proposed for the extension) and double-glazing units that offer an increased sound insulation compared to the minimum performance that would have complied with the building

regulations. Table 8 below presents the sound reduction indices used in the calculation procedure for these elements.

External Building Fabric Element	Construction Element	Sound Reduction Indices (dB) at Octave Band Centre Frequencies (Hz)				
		125	250	500	1000	2000
Glazing configuration, glass mm/airgap mm/glass mm (levels 1-5) facing south, north and east	6 mm glass, 16 mm airgap, 10 mm glass	26	27	34	40	38
Glazing configuration, glass mm/airgap mm/glass mm (levels 6-9) facing south, north and east	6 mm glass, 16 mm airgap, 6 mm glass	20	19	29	38	34
Background ventilation system as per System 4 in Approved Document F	MVHR	Mechanical ventilation				
Non-vision wall	Brick/block cavity wall	41	45	45	54	58

Table 9: Elements of External Building Fabric (Utilizing System 1)

6.11 The assessment has demonstrated that under the worst case scenarios suitable internal ambient noise levels can be met using mechanical ventilation and an uprated double glazing system. It should be noted that if these measures are not adopted, the internal noise impact will most probably not exceed the proposed SOAEL but will exceed the proposed LOAEL.

6.12 It should be noted that the information presented above should not be used for tender purposes. The information in relation to the acoustic performance of external building fabric elements is presented to assist with the planning application. Glazed doors which provide access to a balcony will also have to meet the above sound reduction performance (assuming the information in this report is used for tender purposes without any further reviews).

Impact at Habitable Rooms Partially Screened from Noise Traffic

6.13 The decision (by the M&E Team) to provide whole house ventilation to the apartments, has resulted in internal noise levels meeting the proposed LOAEL, using the minimum required double glazed unit under the building regulations, for a large number of the new apartments. In the absence of an acoustic specification, the most typical double-glazed unit (to comply with thermal performance requirements) is one that comprises 4mm of glazed panes separated by an airgap of around 16mm. Therefore, since mechanical ventilation is proposed for the proposed extensions, an acoustic performance for the glazing is not deemed appropriate for the habitable rooms without a direct line

of sight to the surrounding roads to the south and east of the site. However, it should be noted that the contractor or the developer may opt to provide the same type of glazing throughout the development as this may be of benefit logistically. Even though this solution may create acoustic privacy issues when natural ventilation is used (with background noise levels lower than around 20 dB), the decision to provide whole house ventilation will reduce any acoustic privacy issues (due to an elevation of background noise by the mechanical ventilation system).

Indoor Levels at Converted Office Accommodation

6.14 The office conversion does not require an assessment in relation to traffic noise break in to support the Prior Approval planning application. However, the developer has requested a review of the external building fabric in order to finalize the tender for the new windows and ventilators. It has been confirmed that the office conversion will be ventilated by System 3 in Approved Document F (MEV system) using trickle ventilators (with an effective free area not exceeding 2500mm^2). An acoustic specification for the glazing and ventilators of the converted office accommodation in Clarendon House is presented in Appendix 4. It should be noted that compliance with this specification is solely at the discretion of the developer and it has been based on the guidance in BS8223:2014.

Outdoor Levels

6.15 The extended residential development will contain a variety of outdoor private amenity space for residential occupants.

6.16 The latest set of drawings for the development are dated 11 January 2018. Based on these drawings, the ground floor of the substantial extension to the east contains gardens facing east and north and the lobby into the extension facing south. Levels 1-5 of the extension have apartments with balconies facing south. Level 5 of the extension contains an apartment with a south facing balcony and an apartment with a large terrace facing east. Level 6 to 9 contain small balconies facing south, east and west.

6.17 Based on the results of the noise survey, computer modelling and the subsequent review of the likely incident noise levels around the development, it is clear[3] that the proposed SOAEL will be exceeded on the balconies of some apartments (lower level apartments) overlooking the road network, with the amenity spaces at the top levels of the development facing the road network having incident noise levels at or slightly below the proposed SOAEL. Amenity areas without a line of sight to the

[3] See paragraph 6.5

surrounding road network will not be subject to incident noise levels that exceed the SOAEL and some areas that are sufficiently screened from road noise may also approach the proposed LOAEL.

6.18 The advice in BS8223:2014[4] in relation to outdoor amenity areas may suggest that the proposed private amenity areas, with the exception of the terrace at Level 5, may not be categorised as amenity space and therefore not subject to a planning decision. The noise impact on the private outdoor amenity spaces is greater on lower floor facing Watlington street. To mitigate the impact, recessed balconies have been designed between the ground to the fifth floor. Where projecting balconies had to be introduced to the corner of Queen's Road and Watlington Street winter gardens have been proposed to mitigate the traffic noise. The upper floors of the development, when road traffic noise levels are lower, projecting balconies have been designed.

6.19 The current proposals should therefore be weighted appropriately on the planning balance by the council's planning officers in order to reach a sustainable and holistic solution.

7.0 CONCLUSIONS

7.1 An environmental noise survey at the proposed site was undertaken in order to review the existing incident noise levels at the proposed residential development.

7.2 The assessment of the suitability of the proposed residential extensions for their intended use was undertaken in full accordance with the aims and requirements within the National Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG). The NPPF is a material consideration for planning applications when the local plan does not align closely with its aims.

7.3 The assessment has demonstrated that the noise climate outside the proposed new habitable rooms will not give rise to significant adverse effects on health and quality of life. The assessment has demonstrated that based on the surrounding noise climate and provision of whole house background ventilation, compliance with the building regulations, without the need for enhancement measures, will result in suitable internal noise levels for habitable rooms with no direct line of sight to the surrounding road network. A number of "hot spot "locations may require the provision of an external fabric construction with an enhanced acoustic design which will be considered during the detailed design stage.

[4] Please see relevant text in Appendix 1

7.4 The review of the surrounding noise climate has shown that some of the balconies with a line of sight to surrounding roads may experience incident noise levels that may result in significant noise impacts. To mitigate some of this potential impact, recessed balconies have been proposed to floor one to five. Where projecting balconies are designed for other reasons between floors one to five, winter gardens (fully enclosed balconies) are proposed to mitigate potential noise impact.

7.5 The current proposals in relation to outdoor amenity overlooking the surrounding road network should therefore be weighted appropriately in the planning balance by the council's planning officers in order to reach a sustainable and holistic solution.

APPENDIX 1

PLANNING POLICY AND GUIDANCE DOCUMENTS

NOISE POLICY STATEMENT FOR ENGLAND

The Noise Policy Statement for England (NPSE), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are: "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse effects on health and quality of life;*
- *mitigate and minimise adverse effects on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.*"

The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level), the level above which significant adverse effects on health and quality of life occur.

The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the NPSE). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in that case: *"…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.*"

Importantly, the NPSE goes on to state that: "This does not mean that such adverse effects cannot occur."

The NPSE does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that: "*Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.*"

It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

NATIONAL PLANNING POLICY FRAMEWORK

The National Planning Policy Framework (NPPF) was published in March 2012. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) *Planning and Noise*.

Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by (amongst others) "*preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability.*"

The NPPF goes on to state in Paragraph 123 "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 thorough 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 use since they were established; and*
- *Identify and protect areas of tranquility which have remained relatively undisturbed by noise and are prized for their recreational and amenity value.*"

The NPPF document does not refer to any other documents or British Standards regarding noise other than the NPSE.

Paragraph 11 of the NPPF states that "planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."

Paragraph 12 of the NPPF states that "This National Planning Policy Framework does not change the statutory status of the development plan as the starting point for decision making. Proposed development that accords with an up-to-date Local Plan should be approved, and proposed development that conflicts should be refused unless other material considerations indicate otherwise. It is highly desirable that local planning authorities should have an up-to-date plan in place."

Paragraph 13 of the NPPF states that "the National Planning Policy Framework constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications."

Therefore, if a development/local plan does not align closely with the NPPF, planning decisions should be based on assessments that align with the NPPF. So, for instance, if a development is refused permission due to conflicts with the local plan, this decision can be overturned (i.e. via the appeal process) if the local plan did not closely align with the aims in the NPPF.

Paragraph 17 of the NPPF states that one of the 12 principles of planning is that it should "not simply be about scrutiny, but instead be a creative exercise in finding ways to enhance and improve the places in which people live their lives."

Paragraph 111 states that "Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value. To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account."

PLANNING PRACTICE GUIDANCE - NOISE

As of March 2014, a Planning Practice Guidance (PPG) for noise was issued that provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- whether or not a significant adverse effect is occurring or likely to occur;
- whether or not an adverse effect is occurring or likely to occur; and
- whether or not a good standard of amenity can be achieved.

This guidance introduced the concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). NOAEL differs from NOEL in that it represents a situation where the acoustic character of an area can be slightly affected (but not such that there is a perceived change in the quality of life). UAEL represents a situation where noise is 'noticeable',

'very disruptive' and should be 'prevented' (as opposed to SOAEL, which represents a situation where noise is 'noticeable' and 'disruptive', and should be 'avoided').

As the level increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise level increases, it will then at some point cross the SOAEL boundary.

The LOAEL is described in PPG as the level above which "noise starts to cause 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."

PPG identifies the SOAEL as the level above which "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."

In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that "*…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.*"

The relevant guidance in the PPG in relation to the adverse effect levels is summarized in Table 1.1.

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	Prevent

Table 1.1. PPG Guidance on Adverse Effect Levels

The Planning Practice Guidance states the following in relation to mitigation measures:

> *"For noise sensitive developments mitigation measures can include avoiding noisy locations; designing the development to reduce the impact of noise from the local environment; including noise barriers; and, optimising the sound insulation provided by the building envelope. Care should be taken when considering mitigation to ensure the envisaged measures do not make for an unsatisfactory development."*

In addition:

"consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations".

Reading Borough Council

Reading Borough Council is working on producing a new Local Plan, which will replace the current development plans (the Core Strategy, Reading Central Area Action Plan and Sites and Detailed Policies Document) with a new plan setting out how Reading will develop up to 2036.

Core Strategy

Reading Borough Council's Core Strategy sets out the council's overall planning strategy and important principles for development in Reading. It was adopted in January 2008 and altered in January 2015.

Noise is included within Policy CS34 where it is stated that

"*Pollution and Water Resources Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development. Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution. Development will be permitted on land affected by contamination where it can be demonstrated, to the satisfaction of the LPA, that the contamination can be satisfactorily remediated so that it is suitable for the proposed end use*".

Reading Central Area Action Plan

Reading Borough Council's Central Area Action Plan Core Strategy sets out the council's planning principles for the centre of Reading up until 2026. It contains general policies and details on specific sites it aims to develop and protect.

In Paragraph 7.6 it states that

"*in some cases, residential development is proposed in areas where noise levels may be an issue. It should be possible to mitigate this through the design of the scheme. In order for the internal noise levels to be reasonable and not adversely affect health, it would be necessary to provide a system of ventilation that entirely removes the necessity to open windows, even in very hot weather. Similarly, in terms of air quality, mitigation of impacts on residential development may be required, including means of ventilation that remove the need to open windows, and draw in the lowest levels of pollution possible, for instance from roof sources. This should be secured through the design of the proposal, and planning condition if necessary. Such systems will require additional energy use, which will need to be offset in order to comply with policy CS1 of the Core Strategy.*"

Policy RC9 *Living in the Centre* states that

"*Proposals for residential development within the central area will be assessed against the following criteria…ii Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated*".

Sites and Detailed Policies

Reading Borough Council's *Sites and Detailed Policies* document sets out detailed policies it uses when considering planning applications and identifies sites for development and protection.

Policy DM8: RESIDENTIAL CONVERSIONS states that

"*Proposals to convert properties into self-contained flats or for multiple occupation under Core Strategy Policy CS18 will only be acceptable where:*

- *The proposal respects the physical character of the area and additionally would not, either individually or cumulatively, unduly dilute or harm an existing mixed and sustainable community through the significant loss of single family housing;*

- *There are no unacceptable adverse impacts to other residential properties arising from noise and disturbance in terms of the number and layout of units proposed and the proximity to other properties;*

- *There is appropriate sound insulation between proposed and neighboring units and layouts avoid inappropriate stacking and location of rooms between units.*"

Paragraph 5.4.8 states that

"*Generally, conversions provide for a market need for small, flexibly let accommodation reflecting household formation trends in the population and the more transient nature of parts of the labour market. However, there has been a substantial increase in applications for conversions over recent years as well as evidence of large numbers of unauthorised conversions. It is clear that significant effects on the character of an area or street are being experienced in several parts of Reading where large numbers of conversions are taking place. Such streets are suffering. When calculating the floor area of a property the measurement should be based on the external dimensions as at 1st July 1948 or when built (which ever is the later) from impacts such as significant car parking problems including parking abuse; clutter and untidiness; a plethora of satellite dishes; poor building maintenance; increased activity, noise and nuisance, etc. The quality of conversions, particularly where unregulated, can also be poor, with poor standards of accommodation and health and safety fears*".

DESIGN NOISE LEVELS

Noise control in and around buildings is discussed in various British Standards on an objective and quantifiable basis. The guides suggest criteria or target levels, such as suitable sleeping/resting conditions, and propose noise levels that normally satisfy these criteria/target levels for most people.

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.

This Standard provides recommended guideline values for internal noise levels within dwellings that are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999[5]). These guideline noise levels are shown in Table 1.2, below:

[5] World Health Organisation Guidelines for Community Noise, 1999

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

Table 1.2 BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

BS 8233:2014 advises that: "regular individual noise events…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." The assessment of individual noise events during the night-time may only be considered necessary for intermittent environmental sources such as aircraft of train pass-byes for which there is research available to assist with the quantification of the impact. Individual noise events associated with night-time typical road traffic is not considered to be associated with the rise of significant adverse effects on health and quality of life, and this is indeed the case even if the site is located near a motorway.

The standard also provides advice in relation to design criteria for external noise. It states that:

> *"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.
>
> "Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.

"Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.

"In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

World Health Organisation, Guidelines for Community Noise, 1999 (WHO)

The World Health Organisation (WHO) Guidelines for Community Noise (1999) recommend suitable internal and external noise levels based on dose response research. The levels recommended in this guidance could be correlated to the LOAEL. Relevant guidance from this document is presented below:

Sleep Disturbance (Night-time internal LOAEL)

If negative effects on sleep are to be avoided, the equivalent A-weighted sound pressure level should not exceed 30 dB indoors for continuous noise.

Interference with Communication (Daytime internal LOAEL)

Noise tends to interfere with auditory communication, in which speech is a most important signal. However, it is also vital to be able to hear alarming and informative signals such as door bells, telephone signals, alarm clocks, fire alarms etc., as well as sounds and signals involved in occupational tasks. The effects of noise on speech discrimination have been studied extensively and deal with this problem in lexical terms (mostly words but also sentences). For communication distances beyond a few metres, speech interference starts at sound pressure levels below 50 dB for octave bands centred on the main speech frequencies at 500, 1,000 and 2,000 Hz. It is usually possible to express the relationship between noise levels and speech intelligibility in a single diagram, based on the following assumptions and empirical observations, and for speaker-to-listener distance of about 1 metre:

- speech in relaxed conversation is 100% intelligible in background noise levels of about 35 dB, and can be understood fairly well in background levels of 45 dB.

- speech with more vocal effort can be understood when the background sound pressure level is about 65 dB.

Annoyance Responses (Daytime external LOAEL for private amenity areas)

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB.

High Speed Two Information Paper E20

The HS2 Information Paper E20 (High Speed Two Limited, 2014) describes the application of the aims set out in the NPSE that relate to airborne noise. In particular, it considers research findings on adverse effects on nonrestorative sleep, which indicate that adverse effects on sleep can be avoided if the maximum noise level inside the bedroom does not exceed 65 dB when more than 20 discrete events occur.

The Noise Insulation Regulations 1975

The Noise Insulation Regulations 1975 define the conditions under which dwellings are eligible for noise insulation to control internal noise levels. The conditions relate to the level of traffic noise at the façade, the increase in noise levels as a result of the highway and the contribution of the new or altered scheme to the noise level received at the façade.

Noise insulation qualification criteria must abide by tests that include the following two:

- the facade noise threshold of 68dB $L_{A10\ 18h}$ is met or exceeded;
- that there must be a noise increase of at least 1 dB compared to the prevailing noise level immediately before the construction of a highway or an additional carriageway were begun;

SOAELs for Transportation Airborne Noise

Based on the noise insulation regulations, a façade noise level of 69 dB $L_{A10,\ 18h}$ is therefore considered as unacceptable and can trigger the provision of mitigation measures. This level can therefore be used as the SOAEL in relation to transportation noise in England. The level relates[6] to 64 dB $L_{Aeq,\ 16h}$. Based on guidance[7] in BS8233:2014, an external noise level of 64 dB $L_{Aeq,\ 16h}$ would roughly equate to an internal level of 49 dB $L_{Aeq\ 16h}$, assuming partially open windows for

[6] See document titled "Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping"

[7] BS8233:2014 states that "If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB"

ventilation. As daytime and night-time desirable target levels differ by 5 dB, a night-time SOAEL could be 44 dB $L_{Aeq,\ 8h}$. It should be noted that these internal SOAEL values may be deemed pessimistic since partially open windows for background ventilation do not offer compliance with the relevant building regulations.

BS 4142:2014

British Standard (BS) 4142: 2014 describes a method for rating and assessing sound of an industrial or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations that comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes, upon which sound is incident.

The procedure contained in BS4142 is to quantify the "*specific sound level*", which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15-minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.

The penalty for tonal elements is between 0 dB and 6 dB, and the standard notes: "Subjectively, this can be converted to a penalty of 2 dB for a tone that is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."

The penalty for impulsive elements is between 0 dB and 9 dB, and the standard notes: "Subjectively, this can be converted to a penalty of 3 dB for impulsivity that is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."

The background sound level should be established in terms of the L_{A90} noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15-minute intervals. The standard states that: *"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

- typically, the greater this difference, the greater the magnitude of the impact.
- a difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

The standard goes on to note that: "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

BS4142 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

BS 6472-1: 2008 'Guide to Evaluation of Human Exposure to Vibration in Buildings: Part 1 - Vibration Sources other than Blasting'

The advice contained in BS 6472 states that when vibration is intermittent the Vibration Dose Value (VDV) can be used to assess any potential effects.

The weighted vibration levels can be aggregated to derive the VDVs. The VDV is a single figure descriptor that represents the cumulative dose of transient vibrations, taking into account the frequency spectrum and duration of each event.

The VDV is determined over a 16-hour daytime period or 8-hour night-time period and the guidance in BS 6472 is shown in Table 1.3 below.

Time Period	**Measured Vibration Dose Values $ms^{-1.75}$**		
	Low Probability of Adverse Comment	**Adverse Comment Possible**	**Adverse Comment Probable**
Residential Buildings 16-hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential Buildings 8-hour night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 1.3: Vibration Dose Values ($m/s^{1.75}$) above which various Degrees of Adverse Comment may be expected in Residential Buildings

Source: BS 6472-1: 2008 - Section 6, Table 1

The values in the Table 1.3 can be used to set values for LOAEL and SOAEL in relation to the impact from train induced vibration.

Building Regulations

Part L of the Building Regulations mandates that buildings become more airtight, and Part F stipulates ventilation requirements. Even though there appears to be a contradiction in this, Part L limits uncontrollable ventilation, while Part F requires that ventilation requirements are provided in a controlled manner.

Ventilation Requirements for Habitable Rooms

Background Ventilation

Three types of ventilation are required under Part F. Whole building ventilation provides nominally continuous air exchange that may be reduced or ceased when the building is not occupied. It can be provided via background ventilators operating alone, or together with:

- passive stack ventilators;
- continuous mechanical extract; or
- continuous mechanical supply and extract with heat recovery.

Extract ventilation is applicable to rooms where most water vapour and/or pollutants are released (e.g. kitchens and bathrooms). It can be provided by intermittent fans, passive stack or continuous mechanical extract with or without mechanical supply and heat recovery.

The four systems described in Part F do not present solutions that utilise the use of opening windows for background ventilation. Opening windows do not provide a controllable means of ventilation and also pose security risks. Therefore, it is not possible to offer to the market a residential dwelling that utilises opening[8] windows for background ventilation.

Purge Ventilation

Purge ventilation is required throughout the building to aid the removal of high concentrations of pollutants and water vapour. It is commonly provided simply by opening windows and doors. Even though purge ventilation is recommended via opening windows, the temporary and intermittent occurrence of this does not normally result in an unacceptable increase of internal noise levels.

[8] Meaning without any restrictions on opening size

Part F goes on to say[9] that "*Purge ventilation provisions may also be used to improve thermal comfort, although this is not controlled under the Building Regulations*."

Summary in Relation to Ventilation

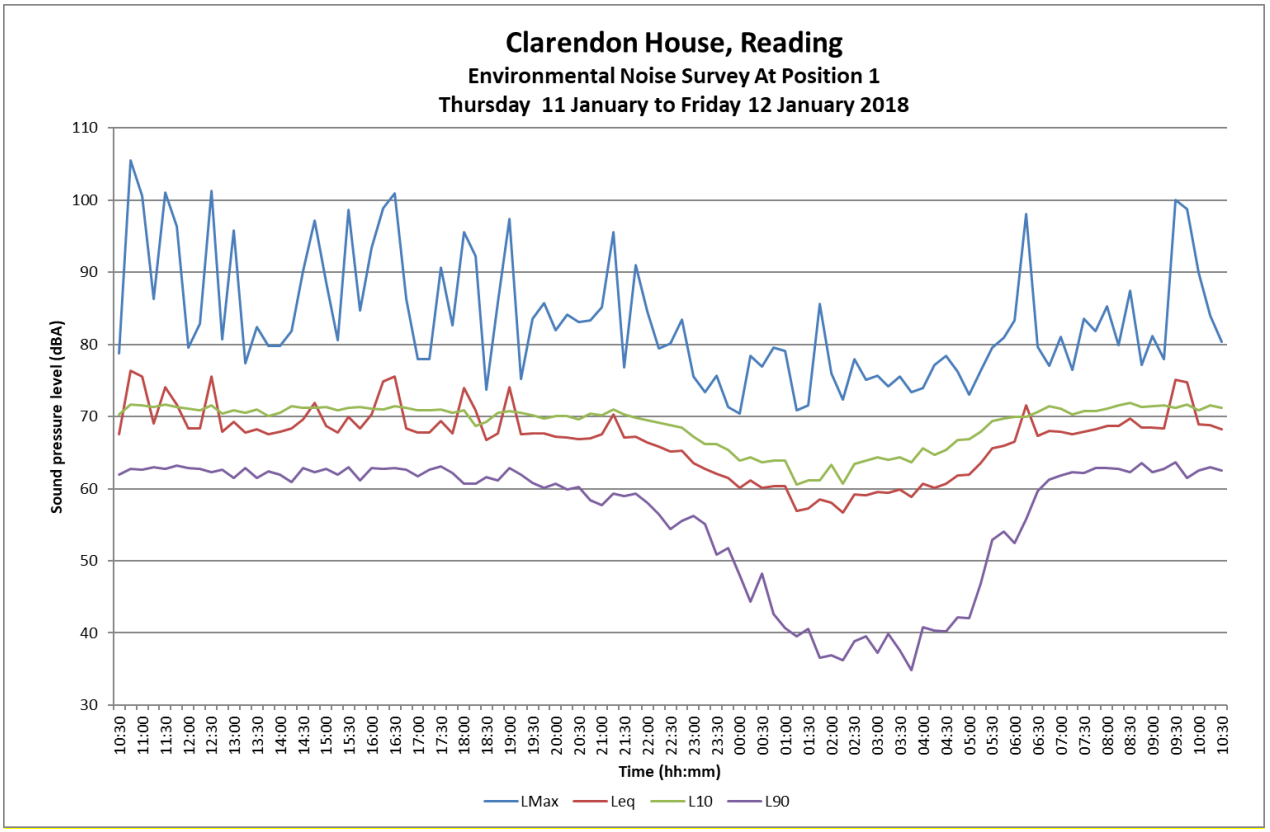
In summary, background ventilation for new residential dwellings should be provided via one of the four systems in Approved Document F. The composite external building fabric should be designed to ensure that appropriate internal noise levels due to external incident noise are met during background ventilation. This can be secured via a planning condition if deemed necessary.

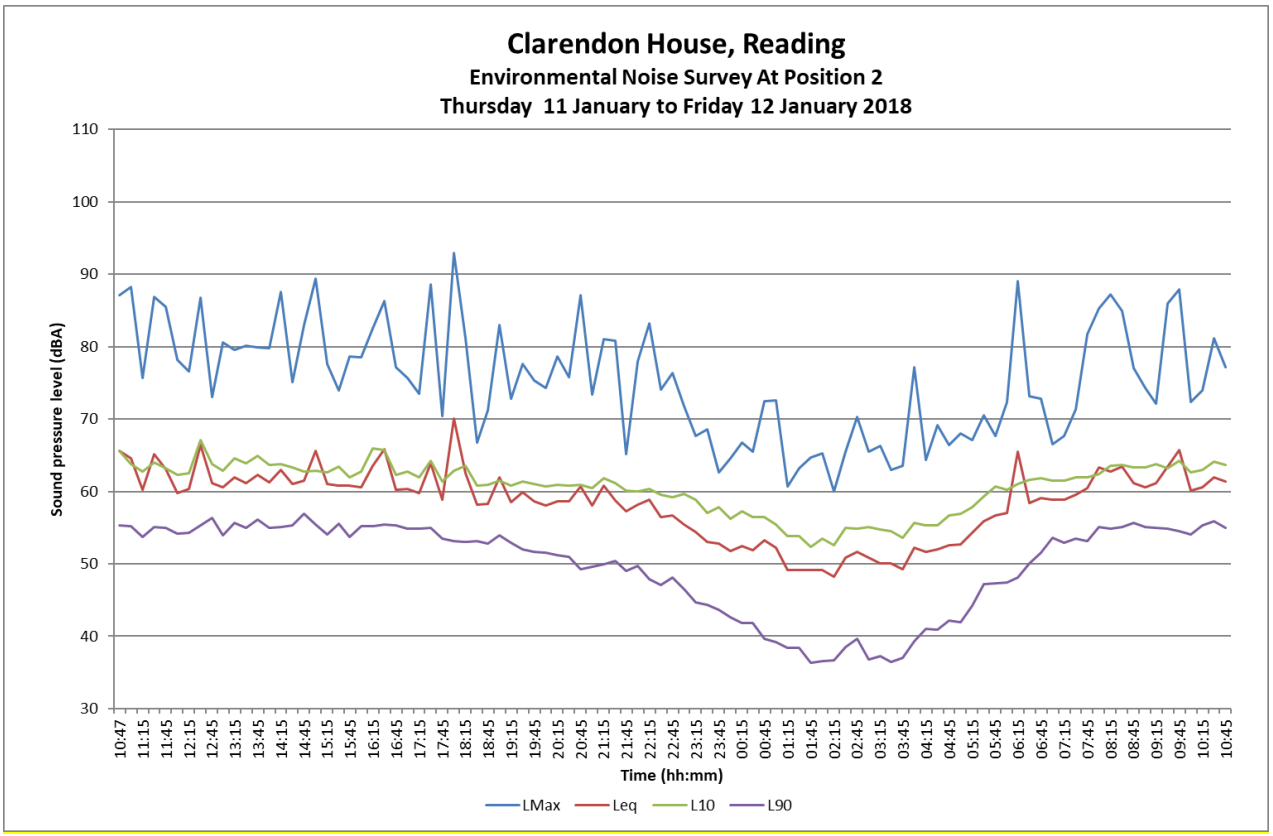
Purge ventilation for residential dwellings should be provided via open windows. The slight increase of internal noise levels should be considered acceptable

APPENDIX 2

RESULTS OF NOISE SURVEY

[9] Paragraph 4.15 in Approved Document F


Clarendon House, Reading
Environmental Noise Survey At Position 1
Thursday 11 January to Friday 12 January 2018
Sound pressure level (dBA)
Time (hh:mm)
LMax
Leq
L10
L90


Clarendon House, Reading
Environmental Noise Survey At Position 2
Thursday 11 January to Friday 12 January 2018
Sound pressure level (dBA)
Time (hh:mm)
LMax
Leq
L10
L90

APPENDIX 3

GLOSSARY

GLOSSARY OF TERMS

Decibels

It is convenient when quantities have a large range to express them in decibel units. The decibel (dB) is a relative unit, showing how much larger or smaller the quantity is relative to a reference value, which is defined as zero on the decibel scale. Decibels are intended to make a large range more readily comprehensible.

A quantity expressed in decibels is commonly called a 'level'.

Many quantities in acoustics are expressed in decibels (see below).

Frequency Weightings

Sounds that would be measured as equal by a sound measuring instrument may not sound equally loud to a human listener, depending on their character, particularly the frequency content (pitch).

Various 'frequency weightings' have been developed that can be used to modify the measured sound in order to produce a value that more closely corresponds to perceived loudness.

One such frequency weighting, the 'A' weighting, has become almost universally used in assessing the effect of prolonged exposure to noise on human health, and features in most Regulations, guidelines and Standards in this area.

A different frequency weighting, the 'C' weighting, has in a similar way become standardised for the measurement and assessment of short-duration sounds for their effect on human health. The 'C' weighting is also used in some methods for assessing the performance of hearing protection.

A sound that has been measured with the 'A' weighting applied is commonly referred to as 'A-weighted'. Similarly, one will see 'C-weighted' where the 'C' weighting has been applied.

Note that sometimes a sound pressure level that has been measured with the 'A-weighting' or 'C-weighting' applied can be found expressed in units of 'dB(A)' or 'dB(C)'. This nomenclature is no longer standard practice.

Quantities and Symbols

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s^1/s^2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20□Pa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), *L*Ax	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) that differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. LA10,18h is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.

APPENDIX 4

ACOUSTIC SPECIFICATIONS

CLARENDON HOUSE, READING

ACOUSTIC SPECIFICATION
FOR WINDOWS TO CONVERTED RESIDENTIAL FACADES

SOUND REDUCTION PERFORMANCE

The complete window configurations shall achieve the following minimum sound reduction indices when tested in accordance with BS EN ISO 10140-2:2010.

Façade	Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
All	24	20	25	34	37	24

TEST DATA

Fully detailed test reports from independent acoustic test authorities shall be supplied. All test reports shall be in English or, a full English translation.

Test data should include the 1/3 octave band results from 100Hz to 3150Hz inclusive, together with the corresponding octave band results from 125Hz to 4000Hz inclusive.

The test report shall be provided for test samples which are representative of the complete glazing configuration - including frames, joints, seals, spandrel panels and opening lights and trickle vents (as appropriate).

CLARENDON HOUSE, READING

ACOUSTIC SPECIFICATION
FOR TRICKLE VENTILATORS TO CONVERTED RESIDENTIAL FACADES

SOUND INSULATION: Ventilators shall be tested in accordance with BS EN ISO 10140-2:2010. This will involve testing in 1/3 octaves from at least 100Hz to 2500Hz inclusive. These results, together with suitably converted octave band results from 125Hz to 2000Hz shall be provided for a ventilator unit which is representative of the proposed ventilator for the relevant façade.

The following element normalised level differences shall be achieved as a minimum:

	Dn,e Values (dB) Open Areas Corrected to 2500mm^2 at Octave Band Centre Frequency (Hz)				
Façade	125	250	500	1k	2k
All	36	29	39	37	60

KRAUSE ARCHITECTS
6 Corbet Place, Jack's Place
Unit 11
London, E1 6NN
T: +44 (0) 20 3397 1070
F: +44 (0) 20 3397 1071
contact@krausearchitects.com

ANDREAS KRAUSE ARCHITECTS LTD
Registered in England & Wales 7005329