



PROPOSED RESIDENTIAL DEVELOPMENT

**TAVISTOCK HOUSE
ROCKINGHAM ROAD, UXBRIDGE**

**NOISE ASSESSMENT
(DISCHARGE OF PLANNING CONDITIONS)**

JULY 2019

A light blue silhouette of a family of four riding a bicycle. The father is in the driver's seat, the mother is seated behind him, and two children are seated in front of the mother. The bicycle has a basket on the front.

the journey is the reward

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**Proposed Residential Development
Tavistock House, Rockingham Road, Uxbridge
Noise Assessment (Discharge of Planning Conditions)**

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1 Introduction

- 1.1 Prior approval for the proposed change of use of Tavistock House, Rockingham Road, Uxbridge from Class B1 (offices) to Class C3 (dwellings) was given by the London Borough of Hillingdon (LBH) on 20 December 2016 (LBH Planning ref. 71923/APP/2016/3622). The prior approval permitted the creation of 16 residential units, with associated car parking, cycle parking and landscaping.

- 1.2 The approval given by LBH was subject to conditions, Condition 2 of which relates to noise and states:

‘Development shall not begin until a scheme for protecting the proposed development from noise has been submitted to and approved in writing by the Local Planning Authority. The scheme shall meet acceptable noise design criteria both indoors and outdoors. Prior to the first use of the property for C3 use, and thereafter, the scheme shall be implemented and maintained in full compliance with the approved measures.

REASON: To ensure that the amenity of the occupiers of the proposed development is not adversely affected by (road traffic) (rail traffic) (air traffic) (surrounding commercial and residential premises) (other) noise in accordance with policy OE5 of the Hillingdon Unitary Development Plan’

- 1.3 In January 2017, planning permission for the conversion of the roof space of the building (to provide an additional 4 residential units) and alterations to the external appearance of the building was granted by LBH. (LBH planning ref. 713923/APP/2016/4576). Again, the permission was conditional and Condition 7 (relating to noise) requires:

“Testing shall be carried out after completion but prior to occupation to show that suitable sound insulation has been achieved. The test results shall be submitted to and approved in writing by the local planning authority, prior to occupation”.

- 1.4 The above condition is a “prior to occupation” condition and cannot therefore be discharged at this time. A separate application to discharge this condition will be made following completion of the development (but prior to occupation).

- 1.5 In January 2108, planning permission was allowed (on appeal to the Secretary of State) for the creation of 3 new studio apartments at ground floor level and further changes to the external appearance of the building (LBH planning ref. 71923/APP/2017/721). The appeal decision includes the following condition relating to noise:

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“Prior to the commencement of the development hereby permitted, details of a sound proofing scheme, certified or to the certified standards of the Association of Noise Consultants or UK Accreditation Services, between each floor shall be submitted to and approved in writing by the local planning authority. No part of the development shall be occupied until the sound proofing has been carried out in accordance with the approved details.”

1.6 Mayer Brown Ltd has been instructed by STA Associates to provide detailed acoustic design advice to assist with the discharge of the above conditions.

1.7 The scope of this Noise Assessment is structured as follows:

- **Section 2** describes the location of the site in relation to the existing transport infrastructure and neighbouring land uses.
- **Section 3** outlines the development proposals.
- **Section 4** discusses the technical requirements of the conditions and relevant design guidance;
- **Section 5** presents the results of historic environmental noise monitoring undertaken at the site (to assist with earlier planning applications) and contemporary noise monitoring to provide more detailed information to assist with the technical appraisals necessary to inform the discharge of conditions.
- **Section 6** deals with the discharge of Condition 2 of LBH Planning ref. 71923/APP/2016/3622;
- **Section 7** deals with the discharge of Condition 7 of the appeal decision for LBH planning ref. 713923/APP/2016/4576.
- Conclusions are presented in **Section 8**.

A glossary of the acoustic terminology and nomenclature used in this report is presented at **Appendix A**.

2 Site Location

- 2.1 The location of the proposed development in relation to the local highway network is shown in **Figure 2.1** below:

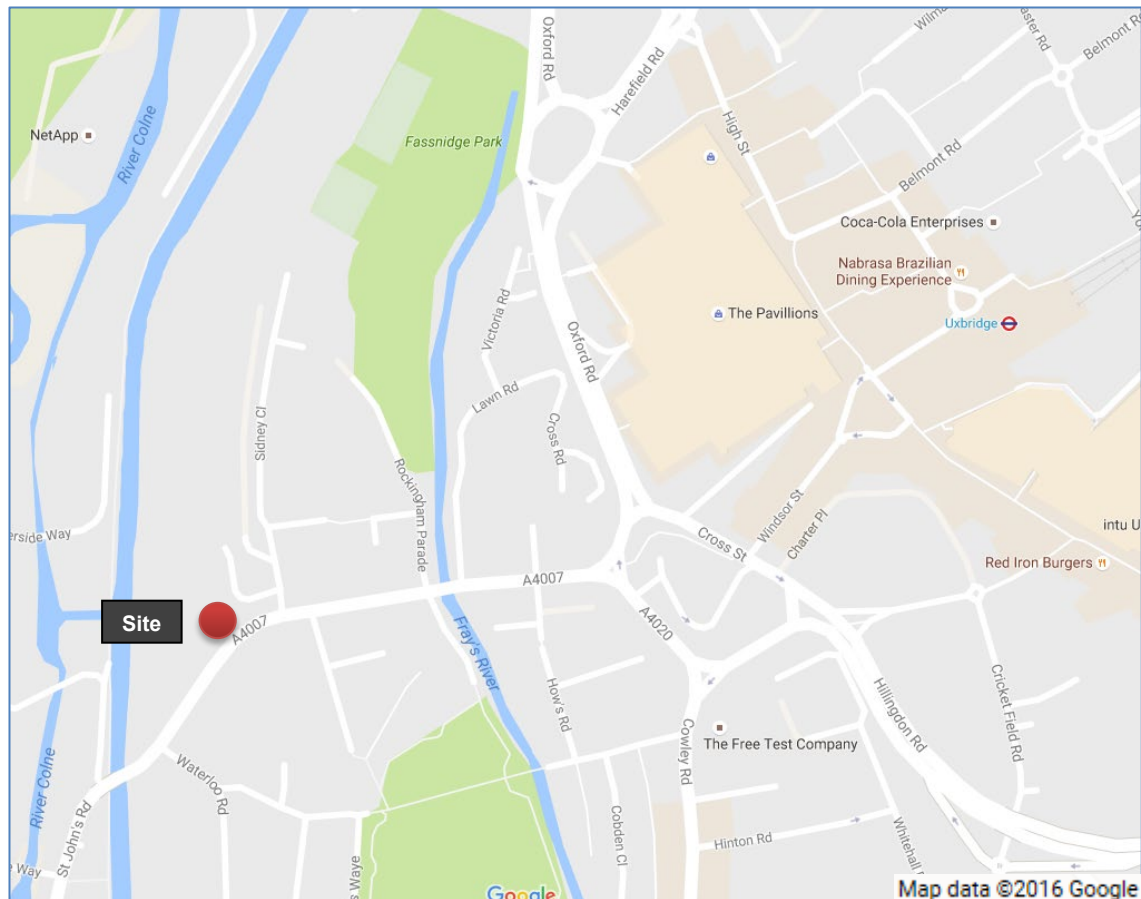


Figure 2.1: Site in Relation to the Local Highway Network

- 2.2 The site is located on the north side of Rockingham Road (A4007), just east of its junction with Waterloo Road, and approximately 500m directly west of Uxbridge town centre and 750m southwest of Uxbridge Underground Station. The River Colne is located to the west and Fray's River is located to the east of the site
- 2.3 The existing building at the site currently provides Use Class B1 (office) accommodation.
- 2.4 The more detailed general arrangement of the site and existing land uses is shown in **Figure 2.2** below:

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Figure 2.2: Site Location

- 2.5 To the north, the site is bounded by Rockingham Wharf which provides access to a number of light industrial units, including a sign writer, a light engineering workshop and a joinery workshop.
- 2.6 To the east, the site overlooks Rockingham Road, on the far side of which is St Mary's Catholic Primary School, a commercial unit at 69 Rockingham Road and a residential terrace of two storey properties to the south.
- 2.7 The south-western boundary of the site is formed with Sheraton House, a three-storey block of flats, to the south of which is a public house (The Dolphin).
- 2.8 To the west, the site adjoins Dolphin Wharf, which is formed by two light industrial units currently in occupation by a lift engineering company and home automation engineering company.

3 Proposed Development

3.1 The development proposals for the scheme (incorporating the internal and external changes permitted by all planning applications) are shown in **Figures 3.1 to 3.4** below:



Figure 3.1: Proposed Ground Floor Layout

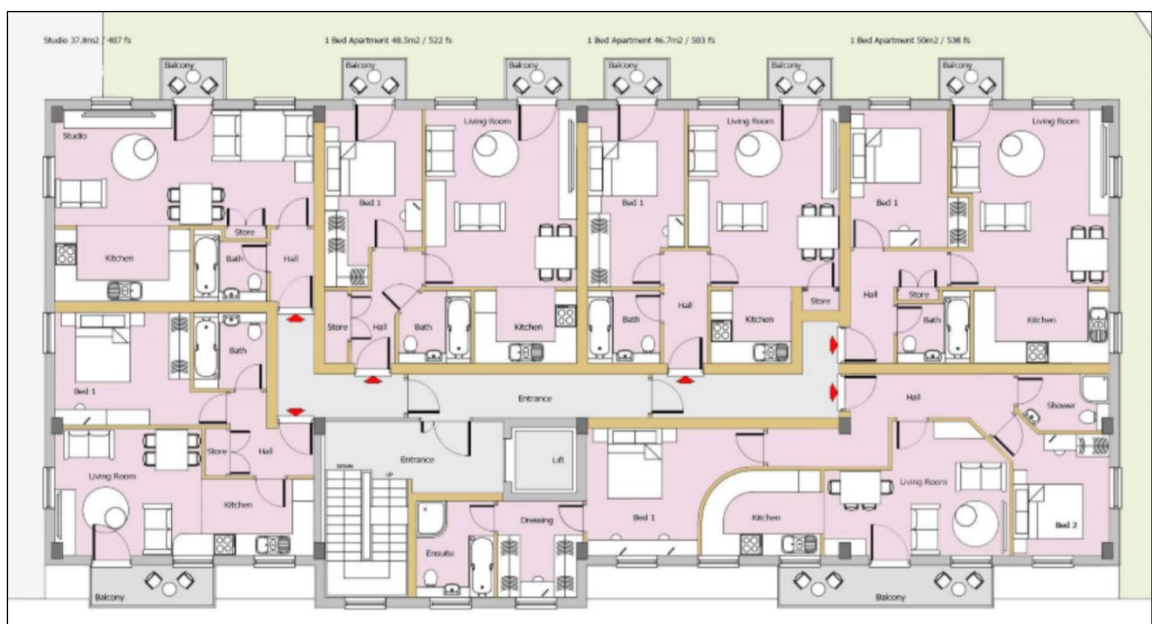


Figure 3.2: Proposed 1st Floor Layout

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Figure 3.3: Proposed 2nd Floor Layout

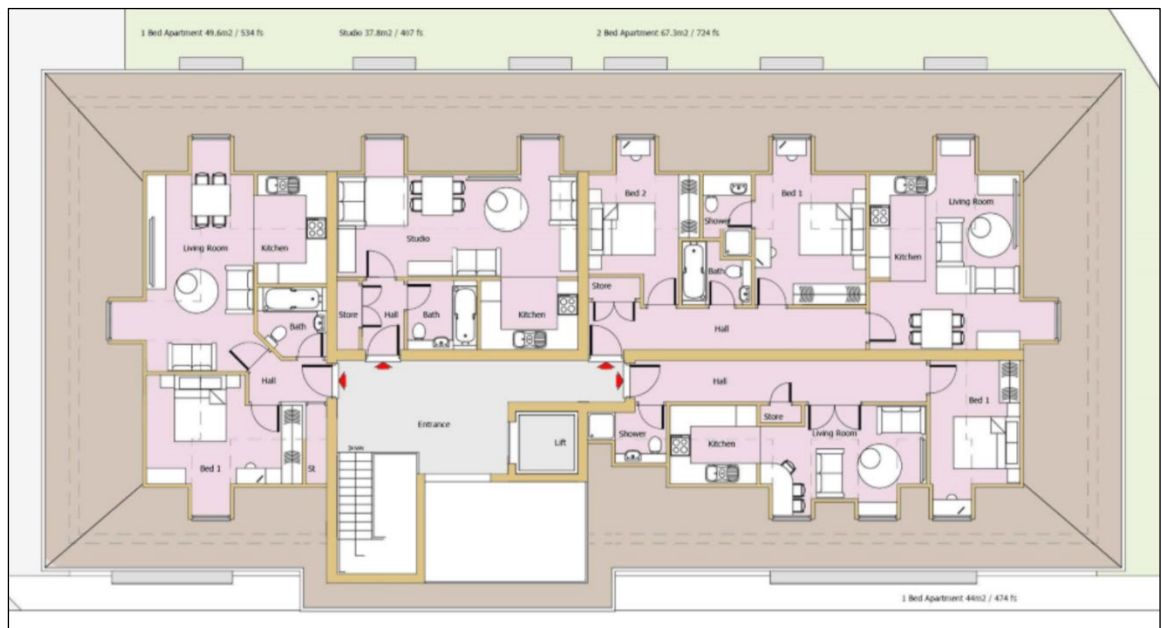


Figure 3.4: Proposed Roof Layout

- 3.2 The external design of the building is shown in the elevation drawings shown in **Figures 3.5 to 3.8** overleaf.

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Figure 3.5: Proposed South Elevation (Rockingham Road)



Figure 3.6: Proposed North Elevation



Figure 3.7: Proposed East and West Elevations

4 Technical Requirements

4.1 Condition 2 of the prior approval consent (ref. 71923/APP/2016/3622) requires:

‘Development shall not begin until a scheme for protecting the proposed development from noise has been submitted to and approved in writing by the Local Planning Authority. The scheme shall meet acceptable noise design criteria both indoors and outdoors. Prior to the first use of the property for C3 use, and thereafter, the scheme shall be implemented and maintained in full compliance with the approved measures.

REASON: To ensure that the amenity of the occupiers of the proposed development is not adversely affected by (road traffic) (rail traffic) (air traffic) (surrounding commercial and residential premises) (other) noise in accordance with policy OE5 of the Hillingdon Unitary Development Plan’

4.2 Whilst neither the planning condition nor UDP policies specify the “acceptable design criteria” to be achieved, the LBH has an adopted Supplementary Planning Document which provides technical guidance on noise criteria for residential developments. This is reproduced below:

TABLE 2: RESIDENTIAL NOISE CRITERIA

		Recommended Noise Level (dB)
Daytime Noise (07:00 - 23:00)	Outdoor living areas	As low as practicable, and < 50 $L_{Aeq,T}$ *(free field)
	Indoor living areas	< 35 $L_{Aeq,T}$ *
Night-time Noise (23:00 - 07:00)	Outside bedroom windows	< 45 $L_{Aeq,T}$ *(façade) < 60 $L_{Amax, Fast}$ (façade)
	Inside bedrooms	< 30 $L_{Aeq,T}$ * < 45 $L_{Amax, Fast}$

Source: Derived from BS8233:1999 and “Guidelines for Community Noise”, World Health Organisation, 1999

* Time base T should be appropriate for the circumstances, typically 1 hour day and 5 minutes night

4.3 Thee criteria are broadly consistent with guidance given in BS 8233: 2014: “Guidance on Sound Insulation and Noise Reduction for Buildings”; the World Health Organisation’s “Guidelines for Community Noise” (1999) and “ProPG: Professional Practice Guidance on Planning and Noise” published by the IOA, ANC, and CIEH.

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BS 8233: 2014: "Sound Insulation and Noise Reduction for Buildings"

- 4.4 BS 8233: 2014 "Sound Insulation and Noise Reduction for Buildings" offers the following design guidance for indoor ambient noise levels within dwellings:

Activity	Location	07.00 to 23.00 hours	23.00 to 07.00 hours
Resting	Living Room	35dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 4.1: BS 8233 Indoor Ambient Noise Level Design Guidance

- 4.5 A note accompanying the above Table states:
- "Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values."*
- 4.6 Despite identifying that maximum values 'may' be set, guidance values for differing types of noise/frequency of events is not given. It can, however, be noted that the recommendations of BS8233 are aligned with guidance set out in the World Health Organisation's "Guidelines for Community Noise", and is discussed later in this section.
- 4.7 A further note to the above Table indicates that where "development is considered necessary or desirable", the above guideline values can be relaxed by 5dB and "reasonable" internal conditions still be achieved.
- 4.8 With regard to external amenity spaces, Section 7.7.3.2 of BS 8233: 2014 states:
- "For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 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."*

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[“Guidelines for Community Noise” \(World Health Organisation, 1999\)](#)

4.9 The criteria outlined in this document provide a summary of research regarding the effects of noise on the community. Section 2 of the Guidelines presents a general discussion regarding the types of noise affecting communities and their measurement. The guidelines promote the use of the $L_{Aeq,T}$ noise index. However, where there are distinct events to the noise, such as with aircraft or railway noise, the guidelines recommend that measures of the individual events should be obtained (using, for example, L_{Amax} or L_{AE}), in addition to $L_{Aeq,T}$ measurements.

4.10 The guidelines identify three critical effects of noise on dwellings – speech interference, annoyance and sleep disturbance.

4.11 With regard to ‘**speech interference**’, section 4.2 of the Guidelines identifies that:

“Speech in relaxed conversation is 100% intelligible in background noise levels of about 35dB(A) and can be understood fairly well in background levels of 45dB(A).

Speech with more vocal effort can be understood when the background sound pressure level is about 65dB(A).”

4.12 With regard to ‘**annoyance**’, section 3.8 of the Guidelines states:

“Annoyance in populations exposed to environmental noise varies not only with the acoustical characteristics of the noise (source, exposure), but also with many non-acoustical factors of social, psychological, or economic nature. These factors include fear associated with the noise source, conviction that the noise could be reduced by third parties, individual noise sensitivity, the degree to which an individual feels able to control the noise (coping strategies) and whether the noise originates from important economic activity.”

4.13 Section 4.2.7 of the Guidelines further states that:

“The annoyance response to noise is affected by several factors, including the equivalent sound pressure level and the highest sound pressure level of the noise, the number of such events, and the time of day. Methods for combining these effects have been extensively studied. The results are not inconsistent with the simple, physically based energy equivalent energy theory, which is represented by the L_{Aeq} noise index.

.....

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

- 4.14 With regard to ‘**sleep disturbance**’, Section 3.4 of the guidelines states:

“If negative effects on sleep are to be avoided the equivalent sound pressure level should not exceed 30dB(A) indoors for continuous noise. If the noise is not continuous, sleep disturbance correlates best with L_{Amax} and effects have been observed at 45dB or less. This is particularly true if the background noise level is low. Noise events exceeding 45dB(A) should therefore be limited if possible. For sensitive people an even lower limit would be preferred. It should be noted that it should be possible to sleep with a bedroom window slightly open (a reduction of outside to inside of 15dB). To prevent sleep disturbance, one should thus consider the equivalent sound pressure level and the number and level of sound events. Mitigation targeted to the first part of the night is believed to be effective for the ability to fall asleep”.

- 4.15 With regard to the frequency of noise events, the WHO guideline’s imply that indicated values should not be exceeded more than 10-15 time per night.

[ProPG: Professional Practice Guidance on Planning and Noise](#)

- 4.16 ProPG: Planning & Noise was published in May 2017. The guidance was authored by representatives from the Chartered Institute of Environmental Health (CIEH), Institute of Acoustics (IOA) and Association of Noise Consultants (ANC) and seeks to consolidate and standardise existing industry best practice in order to expedite the planning process with regard to the consideration of noise.
- 4.17 The guidance set out in this document echoes the recommendations of BS 8233: 2014 and the WHO guidelines, recommending an internal sound level of 35dB $L_{Aeq,16hour}$ for living areas and 30dB $L_{Aeq,8hour}$ / 45dB $L_{Amax,fast}$ for bedrooms. The guidance also promotes that noise levels in external amenity areas should not ideally be above a value of 50-55dB $L_{Aeq,16hour}$.

Floor Sound Insulation

- 4.18 Condition 5 of the appeal decision relating to LBH ref. 71923/APP/2017/721 relates to the need For the submission and approval of a sound proofing scheme between each floor. No technical noise standard is set and neither is advice on such matters provided in the council's aforementioned adopted SPD on noise. Notwithstanding this, it should be noted that sound insulation between residential dwellings is statutorily controlled

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through the provisions of Approved Document E of the Building Regulations 2010 (open as amended). Tables 0.1a and 0.1b of ADE prescribe the following sound insulation requirements for new building party walls and separating floors.

- 4.19 For party walls and separating floors created within a conversion property, the following values are required:

Structure	Airborne sound insulation $D_{nT,w} + C_{tr}$ (dB) (minimum values)	Impact sound insulation $L'_{nT,w}$ (dB) (maximum values)
Walls	43	-
Floors	43	64

Table 4.2: Approved Document E Performance Requirements

- 4.20 For “new build” party walls and separating floors, the relevant values are:

Structure	Airborne sound insulation $D_{nT,w} + C_{tr}$ (dB) (minimum values)	Impact sound insulation $L'_{nT,w}$ (dB) (maximum values)
Walls	45	-
Floors	45	62

Table 4.3: Approved Document E Performance Requirements

5 Existing Noise Environment

Historic Noise Monitoring

- 5.1 Detailed noise monitoring to support earlier applications for development at the site was undertaken in September 2016.
- 5.2 Due to security concerns at the site, it was not possible to install automated noise monitoring equipment, therefore the survey was undertaken using manned measurement instrumentation. The presence of the surveyor also enabled detailed commentary on noise source influencing measurements to be clearly identified.
- 5.3 The survey was undertaken between monitoring was undertaken between approximately 08.15 to 15.30 hours on 7 September 2016.

Automated noise monitoring equipment was installed at two locations as described in **Table 5.1** and shown in **Figure 5.1** below.

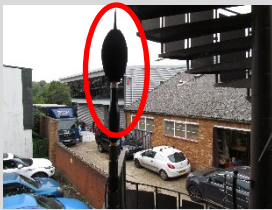
Monitoring Location	Description	Photograph
1	Overlooking Rockingham Road. The measurement was positioned approximately 1m from the front façade of the existing building, by means of a boom pole extended to approximately 1 st floor level.	
2	Overlooking industrial units in Rockingham Wharf. The measurement microphone was positioned approximately 1m from the rear elevation of the building, mounted on a boom pole strapped to the external fire escape at 1 st floor level.	

Table 5.1: Historic Noise Survey Locations

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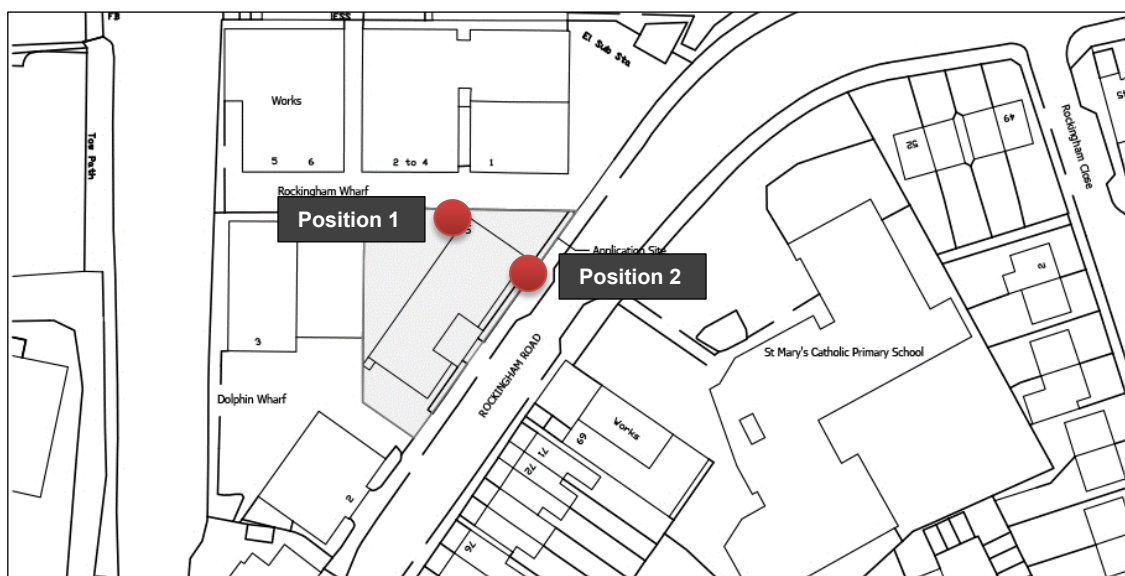


Figure 5.1: Noise Survey Measurement Locations

5.4 The following instrumentation was used for the surveys:

Position	Description	Make	Model	S/No.	Calibration
1	Sound Level Analyser	Norsonic	Nor140	1405946	24/03/2016
	Microphone	Norsonic	Nor1225	41489	
	Preamplifier	Norsonic	Nor1209	15799	
	Outdoor Microphone Kit	Norsonic	Nor 1217	12175120	n/a
2	Sound Level Analyser	Norsonic	Nor140	1405948	24/03/2016
	Microphone	Norsonic	Nor1225	208221	
	Preamplifier	Norsonic	Nor1209	15806	
	Outdoor Microphone Kit	Norsonic	Nor 1217	12175120	n/a
1 & 2	Calibrator	Norsonic	Nor 1251	34058	24/03/2016

Table 5.2: Instrumentation Details

5.5 The sound level analysers were calibrated prior to the survey and the calibration was checked upon completion. No drift in calibration was observed.

Survey Procedure

5.6 The sound level analysers were both configured to record the L_{A90} , L_{Aeq} , and $L_{Amax,fast}$ sound levels over consecutive 1 second periods to provide a detailed time history profile

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showing fluctuations in noise levels. The analysers were also configured to make real-time contemporaneous audio recordings to assist in identifying the source of specific higher magnitude noise “events” observed in the time history profiling.

Noise Monitoring Results

- 5.7 Noise levels measured at Positions 1 and 2 are presented on **Time History Graphs 1 and 2** attached at **Appendix B**.

Weather

- 5.8 Weather conditions during the survey were suitable for undertaken environmental noise measurements being sunny with a temperature of 20-25°C, a light south-easterly breeze (<5m/s) and no precipitation.

Observations and Discussion

- 5.9 Noise levels at Position 1 were dominated by road traffic noise associated with vehicle movements on Rockingham Road. No other sources of commercial noise were observed to have any significant effect on measured noise levels.
- 5.10 Noise levels at Position 2 were also influenced by noise from Rockingham Road (albeit acoustically screened by the massing of the building), but were more generally dominated by noise from building services installations (condenser units) associated with the current commercial occupation of the building. Noise from a joinery workshop in Rockingham Wharf was intermittently audible.

Contemporary Noise Monitoring

- 5.11 In order to verify the results of this earlier survey work and provide additional information to assist with calculations to finalise the sound insulation scheme for the development, an additional noise survey was undertaken between approximately 12.15 to 16.45 hours on 18 June 2019.

Automated noise monitoring equipment was installed at three locations as described in **Table 5.1** and shown in **Figure 5.1** below.

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Monitoring Location	Description
3	Overlooking Rockingham Road at the south eastern boundary of the site. The measurement microphone was positioned approximately 1m from the front façade of the existing building, and approximately 3m above ground level.
4	Overlooking Rockingham Road at the north eastern boundary of the site. The measurement microphone was positioned approximately 1m from the existing building, and approximately 3m above ground level.
5	Overlooking industrial units in Rockingham Wharf. The measurement microphone was positioned approximately 3m from the rear elevation of the building, mounted on a boom pole strapped to the external fire escape at 1 st floor level.

Table 5.3: Automated Noise Survey Locations



Figure 5.2: Noise Survey Measurement Locations

5.12 The following instrumentation was used for the surveys:

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Position	Description	Make	Model	S/No.	Calibration
3	Sound Level Analyser	Svantek	SVAN97 1	55551	04/06/2018
	Microphone	ACO Pacific	7052E	63681	
	Preamplifier	Svantek	SV18	57254	
	Outdoor Microphone Kit	Svantek	SA271U	--	n/a
4	Sound Level Analyser	Svantek	SVAN97 1	55550	04/06/2018
	Microphone	ACO Pacific	7052E	63684	
	Preamplifier	Svantek	SV18	57249	
	Outdoor Microphone Kit	Svantek	SA271U	--	n/a
5	Sound Level Datalogger	Convergence Instruments	NSRT_ mk3	AnN+jF0QW V81qBFwwwj xPD	02/05/2019
All	Calibrator	Norsonic	Nor 1251	34058	08/02/2019

Table 5.4: Instrumentation Details

- 5.13 The sound level analysers were calibrated prior to the survey and the calibration was checked upon completion. No drift in calibration was observed.

Survey Procedure

- 5.14 The sound level analysers were configured to record the L_{Aeq} and $L_{Amax,fast}$ sound levels over consecutive 1 second periods to provide a detailed time history profile showing fluctuations in noise levels. The analysers were also configured to make real-time contemporaneous audio recordings to assist in identifying the source of specific higher magnitude noise “events” observed in the time history profiling.

Noise Monitoring Results

- 5.15 Noise levels measured at Positions 3 to 5 are presented on **Time History Graphs 1-3** attached at **Appendix B**.
- 5.16 Typical noise levels measured are summarised in **Table 5.3** below:

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Location	Time	L _{A90,1mins}	L _{Aeq,1hour}	L _{A10,15mins}	L _{Amax,fast}
3	12:00 – 13:00	59	67	71	85
	13:00 – 14:00	57	67	70	83
	14:00 – 15:00	57	67	71	81
4	12:00 – 13:00	58	69	72	89
	13:00 – 14:00	56	68	72	86
	14:00 – 15:00	56	69	72	86
5	12:00 – 13:00	59	61	63	71
	13:00 – 14:00	59	61	63	82
	14:00 – 15:00	59	61	62	76

Table 5.5: Noise Measurement Results

Weather

- 5.17 Weather conditions during the survey were suitable for undertaking environmental noise measurements being sunny with a temperature of 16-18°C, a light south-easterly breeze (<5m/s) and no precipitation.

Analysis of Data

- 5.18 The measurement data for Positions 3, 4 and 5 has been processed to determine typical daytime (L_{Aeq,16hour}) and night-time (L_{Aeq,8hour}) value due to road traffic noises. These values have been estimated in accordance with the shortened measurement procedure of CRTN¹. This analysis yields a predicted L_{A10,18hour} value from which the L_{Aeq,16hour} and L_{Aeq,8hour} values have been estimated using the procedures developed by TRL/Casella Stanger for DEFRA².
- 5.19 Calculated values are summarised in **Table 5.6** below.

¹ Department of Transport. (1988) "Calculation of Road Traffic Noise". HMSO, London.

² TRL/Casella Stanger (2006) for DEFRA. Method for Converting the UK Road Traffic Noise Index L_{A10,18h} to the EU Noise Indices for Road Noise Mapping.

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Location	Day-time $L_{Aeq,16hr}$ (dB) (07:00 – 23:00)	Night-Time $L_{Aeq,8hr}$ (dB) (23:00 – 07:00)
3	68	59
4	69	60
5	60	52

Table 5.6: Calculated Daytime and Night-time $L_{Aeq,T}$ values

Observations and Discussion

- 5.20 Noise levels at Position 3 were dominated by road traffic noise associated with vehicle movements on Rockingham Road and noise from St Mary's Catholic Primary School. No other sources of commercial noise were observed to have any significant effect on measured noise levels.
- 5.21 Noise levels at Position 4 were also dominated by road traffic noise associated with vehicle movements on Rockingham, with less impact from St Mary's Catholic Primary School. No other sources of commercial noise were observed to have any significant effect on measured noise levels.
- 5.22 Noise levels at Position 5 were also influenced by noise from Rockingham Road (albeit acoustically screened by the massing of the building), but were more generally dominated by noise from building services installations (condenser units) associated with the current commercial occupation of the building. Noise from a joinery workshop in Rockingham Wharf was intermittently audible.
- 5.23 The results of the contemporary noise survey works show very good correlation with the results of the historic survey work undertaken in 2016, confirming that there has not been any significant change to the noise environment in the locality of the site.

6 Condition 2 of PP 71923/APP/2016/3622

- 6.1 This section addresses Condition 2 of LBH prior approval ref. 71923/APP/2016/3622, which requires “*a scheme for protecting the proposed development from noise*” to be submitted and approved by the LPA.

Noise Intrusion - General

- 6.2 The level of sound insulation required of a building façade will be determined by:
- **The noise levels incident on a particular area of façade.** In the case of this development, it is clear that higher levels of sound insulation will be required for facades looking “towards” neighbouring roads, than for units facing away from such sources.
 - **The sound insulation capabilities of the constituent building elements.** For windows set within masonry external walls, noise intrusion will generally be determined by the acoustic performance of the windows.
 - **The relative proportion of building elements.** The sound insulation required will increase as the façade area to a room increases. The sound insulation required of weaker performing elements (e.g. windows) will also increase when the proportional area of these is increased.
 - **The acoustic conditions of the receiving room.** Noise intrusion into acoustically hard (reverberant) rooms, will increase sound insulation requirements.
- 6.3 In order to assess sound insulation, detailed noise intrusion calculations have been undertaken in accordance with BS EN 12354-3:2017 “*Estimation of acoustic performance of buildings from the performance of elements- Part 3: Airborne Sound Insulation Against Outdoor Sound*”.
- 6.4 The baseline data and assumptions used in these calculations are outlined in the following sections.

Incident Noise Levels

- 6.5 Incident noise levels have been evaluated based on the noise levels determined from the computational noise models outlined in Section 5 and summarised in **Tables 6.1 to 6.3** below:

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Noise Index	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
L _{Aeq,16hour}	71	65	62	62	63	60	53	47
L _{Aeq,8hour}	67	61	58	58	59	56	49	43
L _{Amax,fast}	78	72	73	71	70	66	61	51

Table 6.1: Typical Incident Traffic Noise Levels (Rockingham Road)

Noise Index	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
L _{Aeq,16hour}	65	56	53	51	50	47	41	41
L _{Aeq,8hour}	61	52	49	47	46	45	37	37
L _{Amax,fast}	70	61	56	56	61	60	54	45

Table 6.2: Typical Incident Traffic Noise Levels (Rear Elevation)

Noise Index	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
L _{Aeq,1hour}	53	47	46	47	47	50	49	50

Table 6.3: Typical Incident Industrial Noise (Rear Elevation)

- 6.6 Based on site observations, the industrial noise was considered to include characteristics likely to attract attention (intermittency and general characteristics which make the sound discernible from other environmental sound sources). As such, it is proposed that when implementing the above incident noise levels an acoustic character correction of +6dB is applied to give the equivalent “rating” level of the noise.

Architectural Design Information

- 6.7 All calculations are based on relevant drawings for the development prepared by STA Associates.

External Wall Construction

- 6.8 The existing wall construction is understood to be a masonry construction comprising a cavity brick-block wall. It is assumed that this construction is compatible with maintaining the following apparent sound reduction indices.

Noise Assessment (Discharge of Conditions)

Apparent Sound Reduction Index, dB					
125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz
41	43	48	50	55	55

Table 6.4: Estimated Apparent SRI for Solid External Walls Elements

- 6.9 It is understood that it is proposed to retain the existing roof structure and for this to thermally and acoustically enhanced through the incorporation of rigid PIR insulation, internally lined with 2 x 12.5mm layers of “Soundbloc” plasterboard. It is assumed that this construction is compatible with maintaining the following apparent sound reduction indices:

Apparent Sound Reduction Index, dB					
125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz
36	43	47	52	49	52

Table 6.5: Assumed Apparent SRI's for Solid External Walls Elements

Room Acoustic Conditions

- 6.10 As noted earlier, noise intrusion into dwellings will be partially determined by the internal room finishes, which will determine the reverberation times within the building. For the purpose of this assessment, a reverberation time of 0.5 seconds has been assumed for all rooms, in line with the standardised reverberation time implemented in Approved Document E of the Building Regulations 2010.

Ventilation Strategy

- 6.11 It is understood that the whole building and extract ventilation requirements of Approved Document E are to be achieved through the use of continuous mechanical extract system, in line with System 1 of Approved Document F of the Building Regulations 2010 (as amended), i.e. passive ventilators (e.g. trickle vent) and intermittent extract.

Glazing & Ventilator Sound Reduction Performance Requirements

- 6.12 Calculations have been undertaken in accordance with the methodology of BS EN ISO 12354-3: 2017: “Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound” to

Noise Assessment (Discharge of Conditions)

- determine typical sound reduction performance requirements for windows and ventilators.
- 6.13 Consideration has been given to the daytime traffic noise intrusion to living rooms and bedrooms in terms of the $L_{Aeq,16\text{hour}}$ noise index. Calculations have also been undertaken for the flats overlooking Rockingham Wharf (i.e. dwellings potentially exposed to commercial/industrial noise), in terms of the $L_{Aeq,1\text{hour}}$ noise index, to which a 6dB character penalty has also been added.
- 6.14 For bedrooms, calculations of night-time noise intrusion in terms of the $L_{Aeq,8\text{hour}}$ and $L_{Amax,fast}$ noise indices have been undertaken.
- 6.15 These calculations indicate that traffic noise intrusion into flats fronting Rockingham Road will require an enhanced specification of glazing rated at R_w 38dB and “acoustic” trickle vents rated at $D_{ne,w}$ 41 dB. Noise intrusion into flats on the rear elevation of the building should be adequately controlled with standard “thermal” double glazing and “acoustic” trickle vents rated at $D_{ne,w}$ 35dB.
- 6.16 The proposed sound insulation scheme is summarised in **Figure 6.1** below.

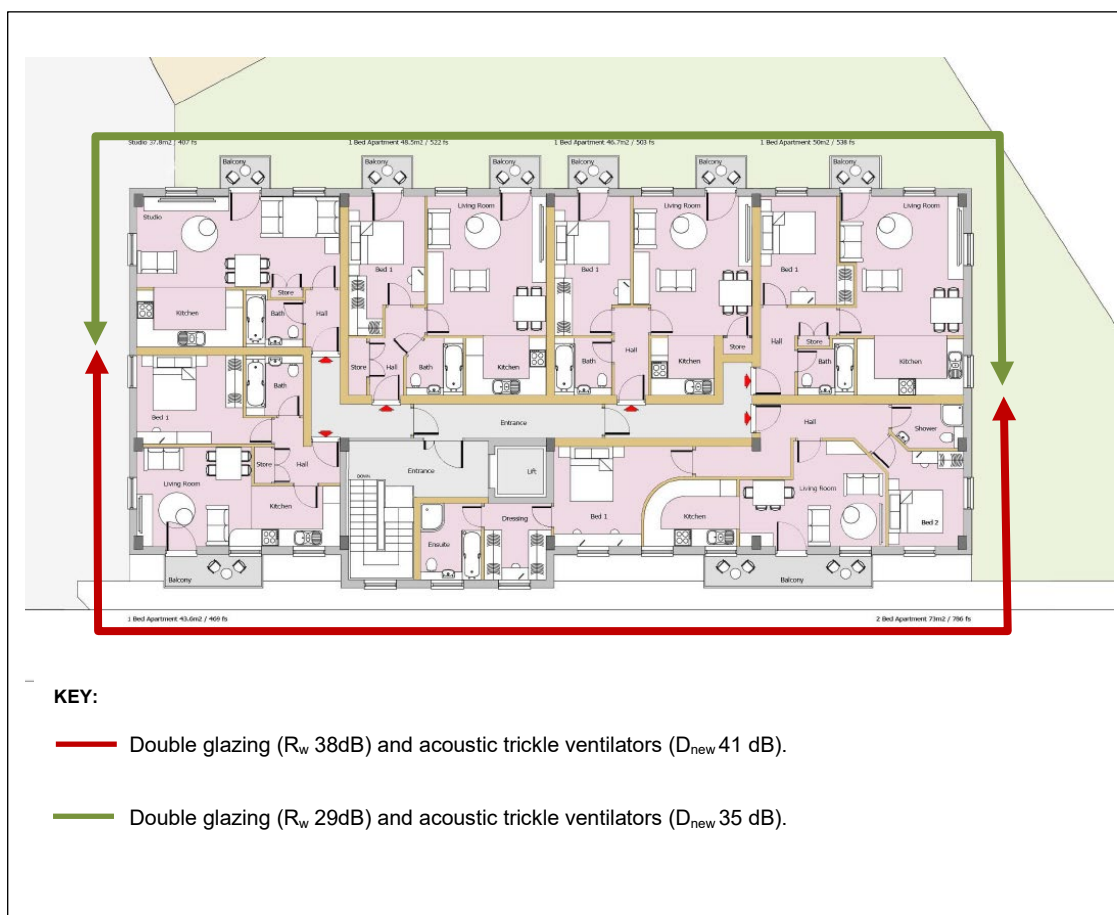


Figure 6.1: Acoustic Performance Recommendations

Noise Assessment (Discharge of Conditions)

- 6.17 The acoustic performance values are expressed in terms of octave band “Sound Reduction Indices” (R) and “Normalised Sound Level Differences” (D_{ne}) as determined in accordance with BS EN ISO 10140-2:2010: ‘*Acoustics. Laboratory Measurement of Sound Insulation of Building Elements. Measurement of Airborne Sound Insulation.*’ and BS EN ISO 10140-4:2010: ‘*Acoustics. Laboratory measurement of sound insulation of building elements. Measurement procedures and requirements*’.
- 6.18 Sample calculation to demonstrate the technical adequacy of the above recommendations are attached at **Appendix C**.
- 6.19 The sound insulation offered by a window system is not solely dependent upon the thickness of glass and separating airspace. The framing details, sealing arrangements etc. will all affect how the system will perform in practice. In view of this, it is not normally appropriate to recommend specific glazing configurations to meet the specified performance requirements and compliance should be verified by reference to acoustic data from proposed manufacturer’s/suppliers.
- 6.20 It should be noted that the trickle ventilator performance indicated assume a single trickle vent per habitable room. If more than one ventilators needs to be installed, the acoustic performance value for **each** ventilator will need to be increased in line with the corrections set out in the following table:

No of Ventilators	Correction to be Applied to Specified D_{ne} Performance Value
1	0
2	+3
3	+5

Table 6.6: Corrections for Multiple Ventilators

- 6.21 It is recommended that the acoustic performance requirements set out above form part of the tender documentation and that suppliers are requested to submit appropriate evidence to demonstrate compliance with the specified values.

External Amenity Areas

- 6.22 Condition 2 of the prior approval application also makes reference to external amenity areas. Since the issue of the prior approval notice, the scheme has been further developed adding new residential accommodation at roof level, additional external

Noise Assessment (Discharge of Conditions)

alterations (including the provision of balconies) and new accommodation and external amenity areas at ground floor level.

6.23 The location and design of the proposed balconies and external amenity areas has therefore already been approved under LBH planning refs. 713923/APP/2016/4576 and 71923/APP/2017/721.

6.24 It should also be noted that the external amenity area shown on the approved drawings relating 71923/APP/2016/3622 does not form part of the current, more comprehensive development intent for the site (as shown on the drawings for 71923/APP/2017/721). The external amenity provision proposed by 71923/APP/2017/721 was specifically considered by the Planning Inspector when determining the appeal for this development, following the LPA's refusal of permission. The Inspector concluded:

17. At my site visit I noted that the currently approved external amenity space for the conversion would be located immediately adjacent to the large and imposing flank wall of the adjacent industrial buildings. I consider that the adjacent wall would diminish the quality and usability of that approved space.

18. I do not consider the amenity space now proposed to be of particularly high quality given its limited size and its location in the corner of the site adjacent to both the main road and the access road to commercial buildings adjacent to the side of the site. However, of the total of nineteen residential units within the scheme as a whole, the large majority would be either studio flats or one bedroom flats. The development therefore is unlikely to be one that would be occupied by many families.

19. Furthermore, it is very material to this case that the site is in close proximity to large areas of public amenity space including the Rockingham Recreation Ground and Fassnidge Park. Such public space would provide for easily accessible and attractive amenity space for the occupants of the flats. Indeed, I consider it to be more likely that residents would opt to use these spaces for outdoor relaxation or recreation than either the previously approved or currently proposed areas of shared amenity space within the development. These factors along with the terraces and balconies provided to most of the individual flats, leads me to the conclusion that the level of amenity space provision is satisfactory in this case."

6.25 In light of the above, the requirement of Condition 2 of 71923/APP/2016/3622 (insofar as it relates to external amenity areas) is considered to have been discharged through subsequent approvals to the scheme.

Noise Assessment (Discharge of Conditions)

6.26 Governmental planning practice guidance also supports that noise impacts can be offset through the availability of access to publicly available amenity space, i.e. paragraph : 009 Reference ID: 30-009-20140306 of PPG states:

Are there further considerations relating to mitigating the impact of noise on residential developments?

Yes – the noise impact may be partially off-set if the residents of those dwellings have access to:

- a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling, and/or;
- a relatively quiet external amenity space for their sole use, (eg a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or;
- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;
- a relatively quiet, protected, external publically accessible amenity space (eg a public park or a local green space designated because of its tranquillity) that is nearby (eg within a 5 minutes walking distance).
- and access to alternative publicly accessible amenity provision.

7 Condition 5 of PP 71923/APP/2017/721

- 7.1 This appeal decision for 71923/APP/2017/721 includes the following condition relating to noise:

“Prior to the commencement of the development hereby permitted, details of a sound proofing scheme, certified or to the certified standards of the Association of Noise Consultants or UK Accreditation Services, between each floor shall be submitted to and approved in writing by the local planning authority. No part of the development shall be occupied until the sound proofing has been carried out in accordance with the approved details.”

- 7.2 The condition requires the submission of details of a “sound proofing scheme” to demonstrate that appropriate sound insulation will be provided between each floor of the development.

- 7.3 Whilst the need to ensure adequate sound insulation through separating floors is not disputed, this is not considered to be a material planning consideration for the proposed development. The reason for this is that sound insulation “between floors” is a matter statutorily controlled through Approved Document E (ADE) of the Building Regulations 2010 (as amended). Requirement E1 of ADE requires that:

“Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining premises”.

- 7.4 In light of the above, the requirement imposed by Condition 5 is unnecessary and is indeed contrary to governmental Planning Practice Guidance which directs that the planning regime should not duplicate the statutory controls of other regimes. This is clearly set out in paragraph 005, reference ID: 21a-005-20140306 of governmental national planning practice guidance which outlines the approach that should be taken to imposing conditions and states:

“Conditions requiring compliance with other regulatory requirements (eg Building Regulations, Environmental Protection Act):

Conditions requiring compliance with other regulatory regimes will not meet the test of necessity and may not be relevant to planning,”

Noise Assessment (Discharge of Conditions)

- 7.5 Other wording within the condition also creates some technical difficulty. To help explain this, it should be noted that whilst the Association of Noise Consultants and other UK Accreditation services have registration schemes for the reporting of “Pre-Completion Testing” required by Approved Document E (i.e. testing that is required following the completion of a development, but prior to occupation), there are no “certified standards” of reporting “design stage” advice, as implied by the condition.
- 7.6 The condition relates to “each floor” of the development, which therefore creates a need for consideration to be given to both the “existing” floors on the upper levels of the building, in addition to the new separation that would be created between the new ground floor units and first floor and the 2nd /roof levels of the building. A forensic analysis of the wording of this condition does therefore lead to some difficulty in terms of the context of discharge.
- 7.7 In light of the above, it is considered that the requirements of the condition can be discharged as a matter of course, since the subject premises will be subject to formal pre-completion testing to discharge the statutory obligations of the Building Regulations and that occupation of the building can only be permitted following a satisfactory demonstration of compliance to the relevant Building Control Authority.

8 Conclusions

Existing Noise Environment

- 8.1 Contemporary noise monitoring has been undertaken to verify and supplement historic noise survey work supporting earlier planning applications for the change of use and other development at the site.
- 8.2 The front (Rockingham Road) elevation of the building is dominated by local traffic movements on Rockingham Road.
- 8.3 Traffic noise levels at the rear of the site are lower (due to the inherent screening effects of the building). However, rear windows are also influenced to some degree by operational noise from existing commercial/industrial units occupying Rockingham Wharf.

Condition 2 of 71923/APP/2016/3622

- 8.4 Detailed calculations have been undertaken to determine the sound insulation requirements of external building elements to adequately control noise intrusion into the development, in line with the requirement of Condition 2 of LBH Planning ref. 71923/APP/2016/3622.
- 8.5 Acoustic performance specifications for proposed windows and alternative means of ventilation are presented and detailed calculations are provided to demonstrate the effectiveness of these recommendation.
- 8.6 This technical evidence is considered to provide an appropriate basis for the discharge of this Condition.

Condition 7 of 71923/APP/2016/4576

- 8.7 This condition is not a “prior to occupation” condition and cannot therefore be discharged at this time. A separate application to discharge this condition will be made following completion of the development (but prior to occupation).

Condition 5 of 71923/APP/2017/721.

- 8.8 This condition is considered to replicate the statutory control of sound insulation between dwellings enforced through Approved Document E (ADE) of the Building Regulations 2010 (as amended). Since the need for adequate sound insulation between floors of the development will need to be demonstrated as a matter of course (through pre-completion testing, in accordance with ADE) and that occupation of the building will not be permitted

Noise Assessment (Discharge of Conditions)

until the relevant Building Control Authority have provided the appropriate evidence to discharge the requirements of ADE, Condition 5 is not considered to be necessary or relevant to planning and the LPA is therefore requesting requested to discharge the condition (on the basis that compliance will be demonstrated as a matter of course through an alternative regulatory regime).

APPENDIX A: Glossary of Acoustic Terminology

General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as “sound”.

Measurement Units

The human ear can detect sound pressures as low as about 20 μPa , and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in “acoustic shorthand” as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20 μPa , thus a sound pressure of 20 μPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with “normal” hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. “Low” pitched sounds fluctuate less times per second than “high” pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an “A-weighting” network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in “acoustic shorthand” as L_A.

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a “Fast” time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it’s nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from “clanking” types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as “noticeable”
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$	This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.
$L_{Amax,fast}$	This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.
$L_{A90,T}$	This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w	The " Weighted Sound Reduction Index " (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013.
R'_w	The " Weighted Apparent Sound Reduction Index " (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission).
D_w	The " Weighted Sound Level Difference " (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements.

Measurement values are determined in accordance with BS EN ISO 140-4: 1998 (for Building Regulations compliance purposes) or BS EN ISO 16283-1: 2014 and weighted in accordance with BS EN ISO 717-1: 2013.

$D_{n,fw}$	The " Weighted Normalised Flanking Level Difference " ($D_{n,fw}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-1: 2013.
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Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

$L_{nT,w}$	The " Standardised Impact Sound Pressure Level " is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 2013.
$L_{n,fw}$	The " Normalised Flanking Impact Sound Pressure Level " is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-2: 2013.

Room Acoustic Measurements

T	The " Reverberation Time " (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT) to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.
α_p	The " Practical Acoustic Absorption Coefficient " (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.
α_w	The " Weighted Absorption Coefficient " (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

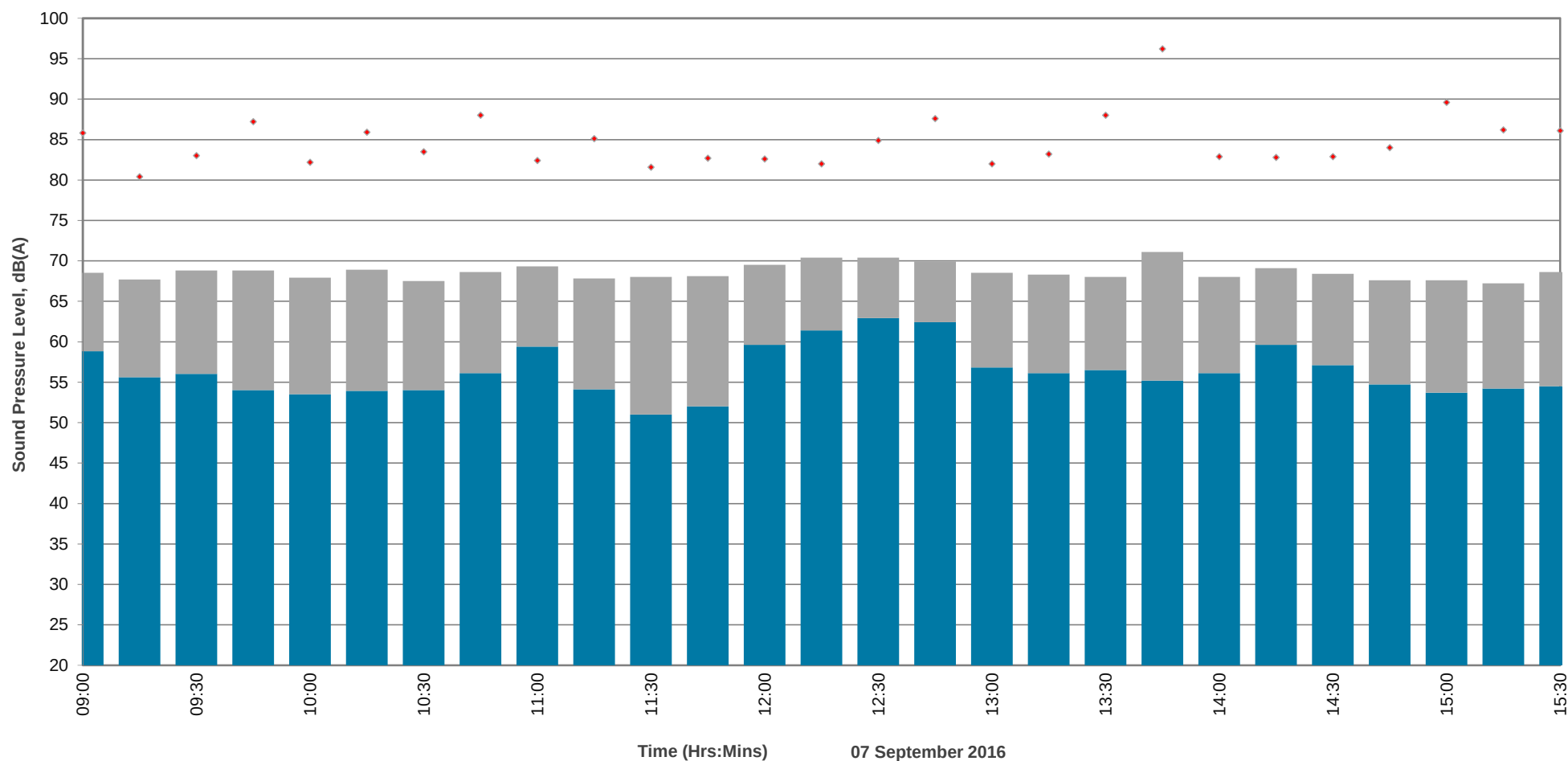
APPENDIX B: Noise Monitoring Time History Plots

Time History Graph 1

Project: Tavistock House, Uxbridge

Measurement Location: Position 1 - Overlooking Rockingham Road

Survey Period: 07 September 2016



KEY:



L_A90,15mins



L_Aeq,15mins

♦ L_Amax,fast

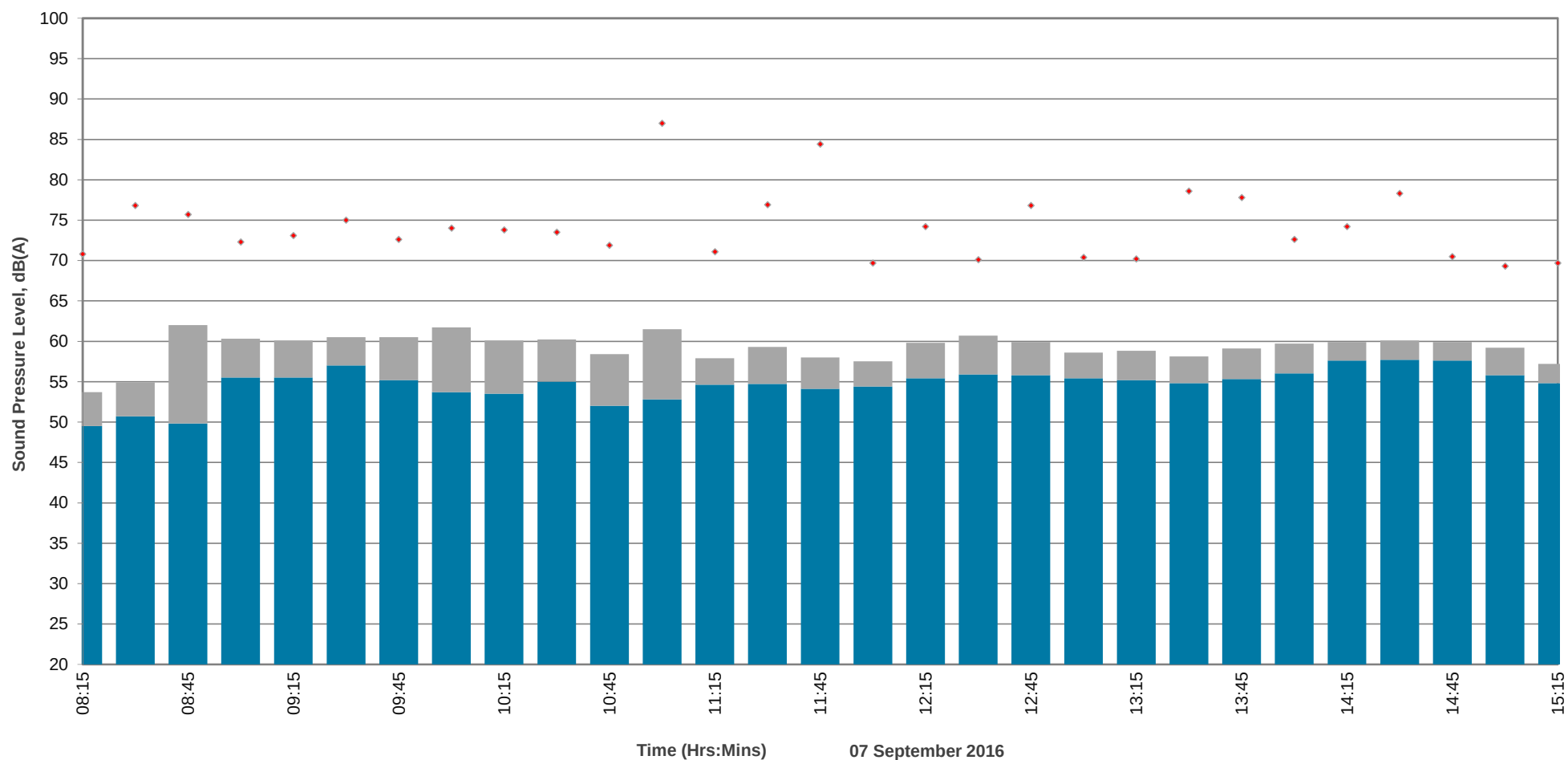
Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

Time History Graph 2

Project: Tavistock House, Rockingham Road, Uxbridge

Measurement Location: Position 2 - Overlooking Rockingham Wharf

Survey Period: 07 September 2016



KEY:



L_A90,15mins



L_Aeq,15mins

♦ L_Amax,fast

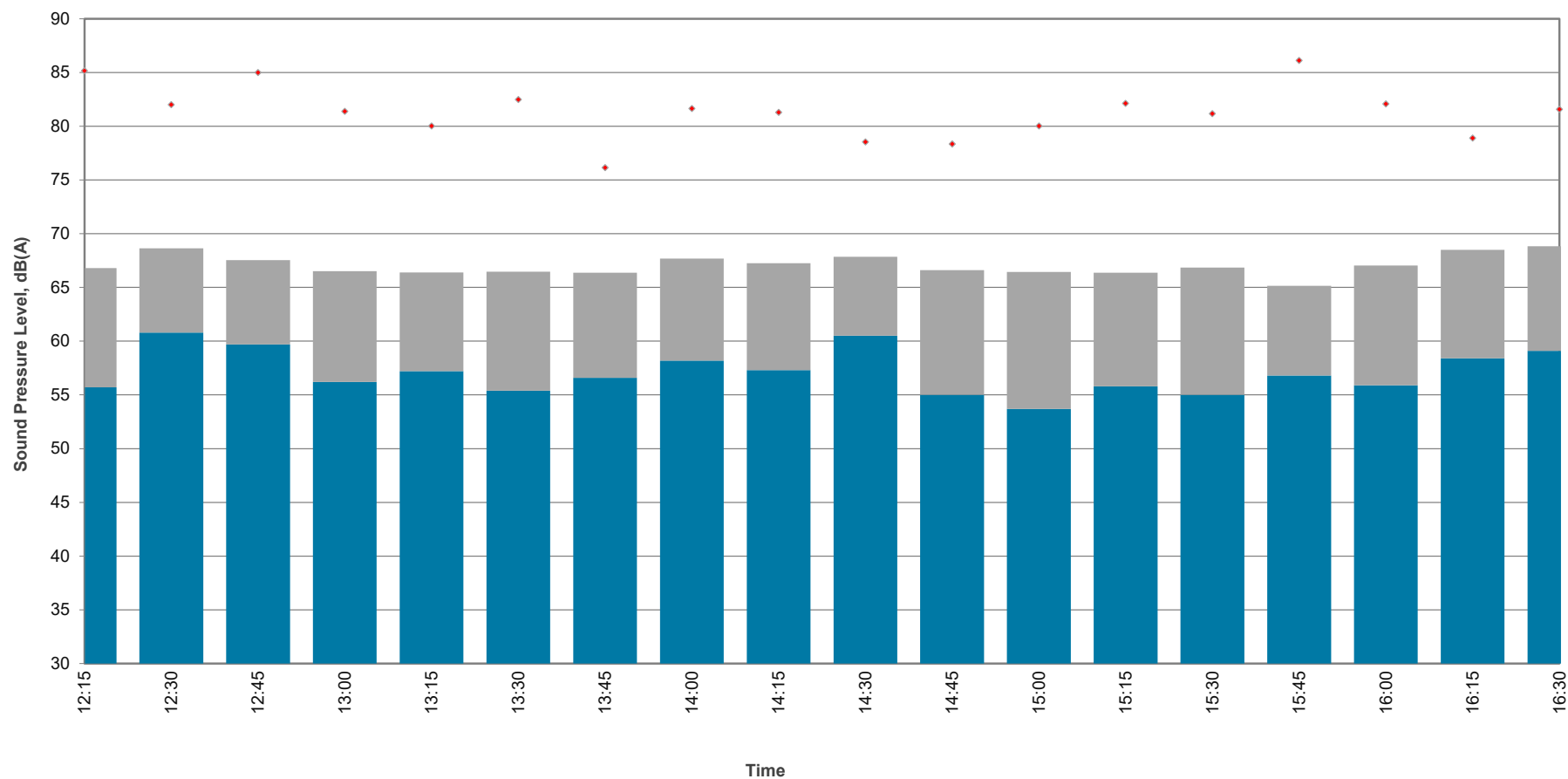
Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

Time History Graph A3

Project: Tavistock House, Rockingham Road, Uxbridge

Measurement Location: Position 3 (overlooking Rockingham Road)

Survey Period: 18/06/2019



KEY:



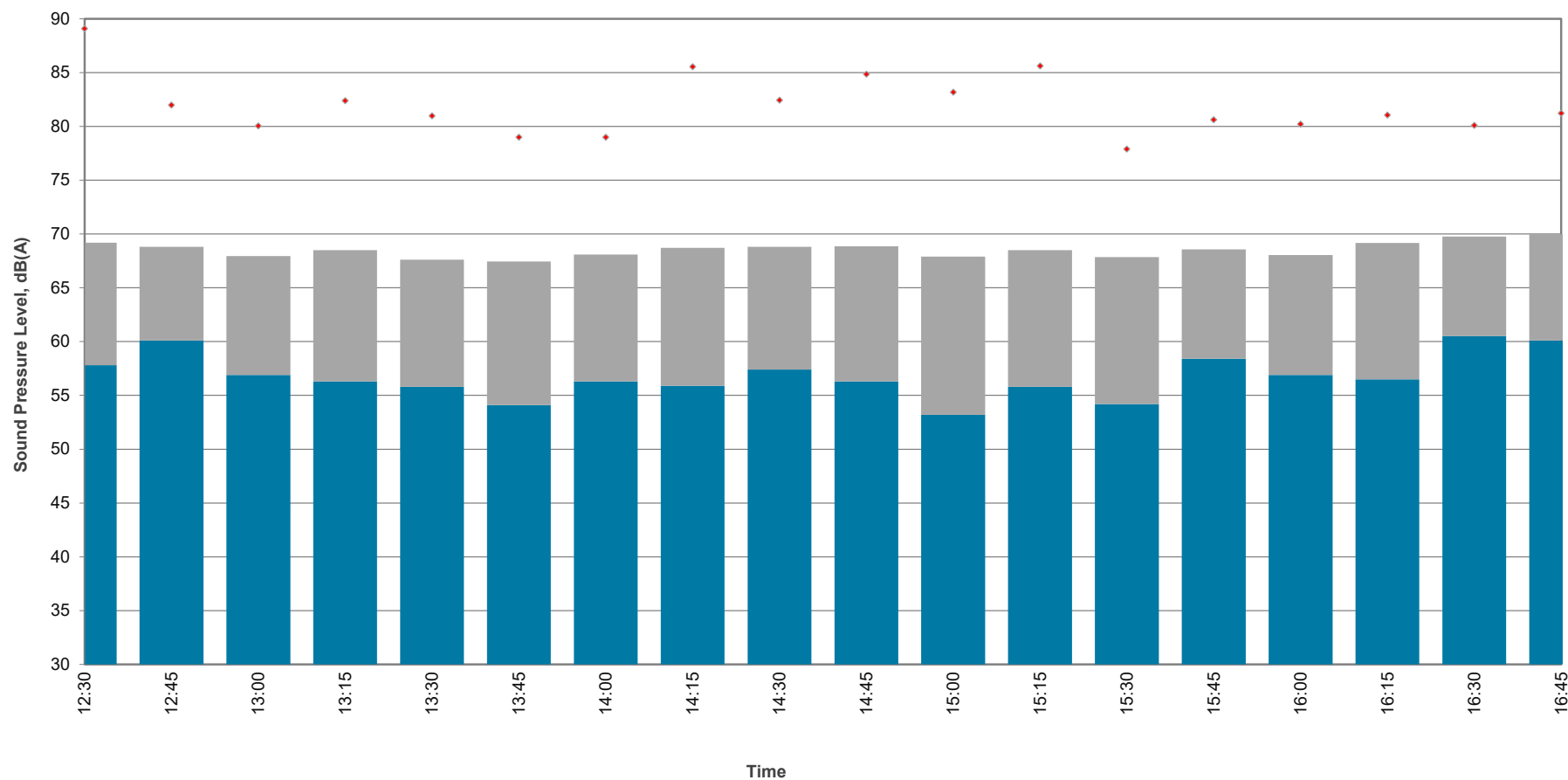
Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

Time History Graph A4

Project: Tavistock House, Rockingham Road, Uxbridge

Measurement Location: Position 4 (overlooking Rockingham Road)

Survey Period: 18/06/2019



KEY:



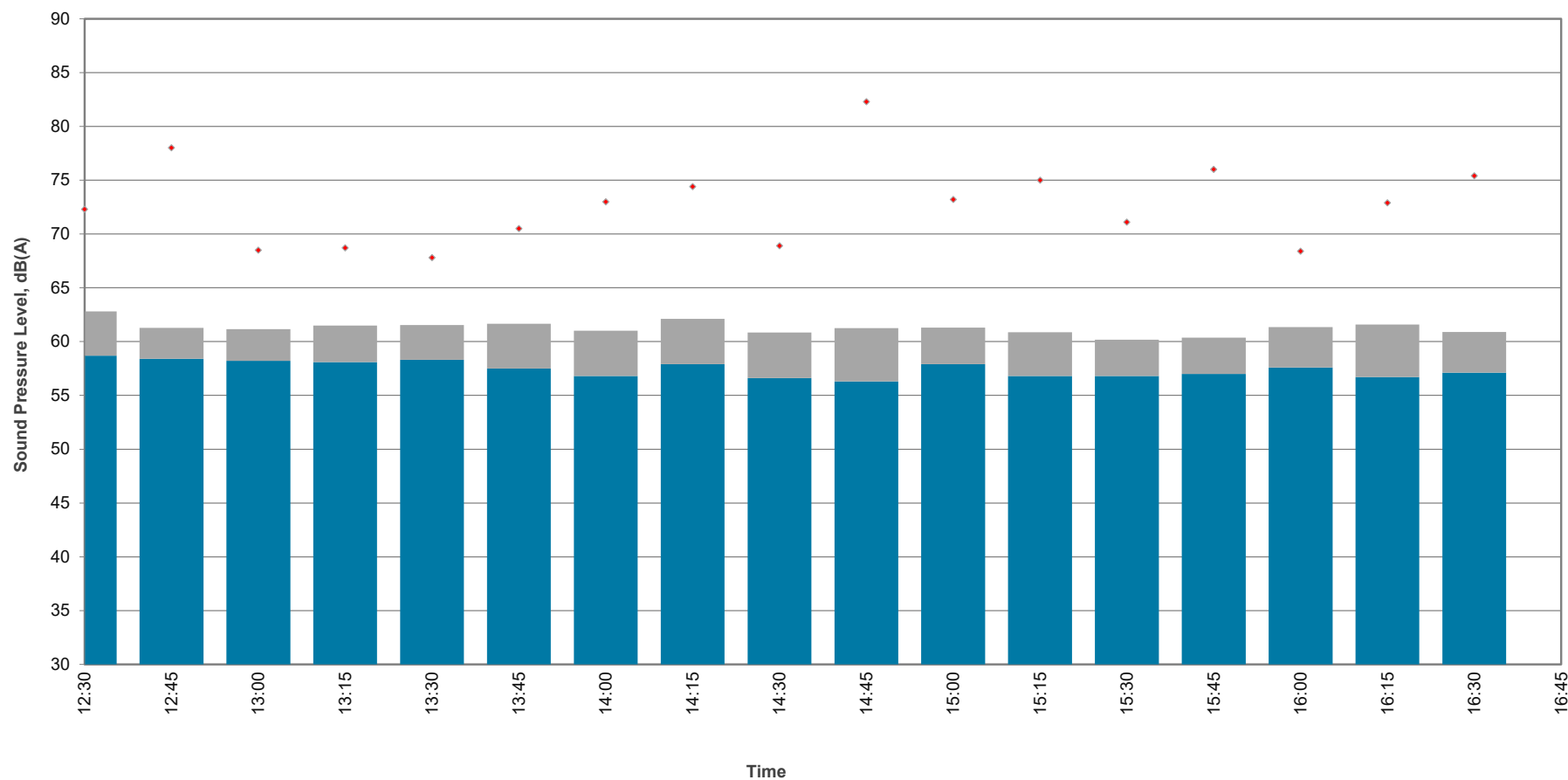
Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

Time History Graph A5

Project: Tavistock House, Rockingham Road, Uxbridge

Measurement Location: Positon 5

Survey Period: 18/06/2019



KEY:



Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

APPENDIX C: Manufacturer’s Literature for Secondary Glazing Systems

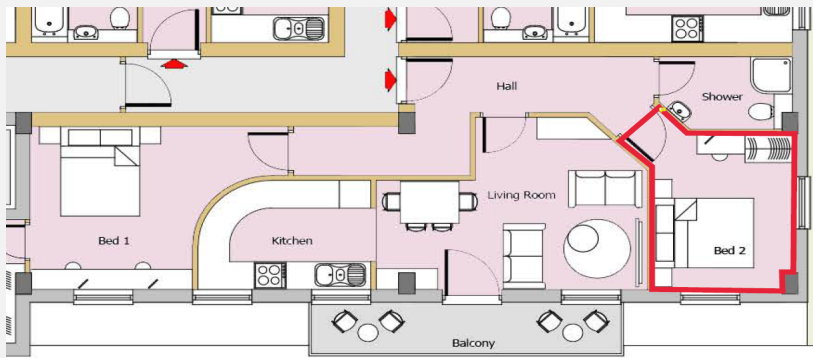
Calculation Sheet		First Floor, 2 Bed Apartment Overlooking Rockingham Road			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	5.85	2.83	3.07	8.83	24.99



Term	Description	Units	Value
Sf	Total façade area	m ²	16.6
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	3.1
Sew	External Wall Area	m ²	13.5
V	Volume of receiving room	m ³	25.0
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.0

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Leq,ff, Daytime	65	62	62	63	60	53	66	L _{Aeq,16hour} value
Ventilator, Dne	40	38	32	47	54	48	41	High Performance Acoustic Trickle Vent
Window SRI, Rwi	22	27	35	42	41	48	38	High Performance Acoustic Glazing
Solid Wall SRI, Rew	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R'w	-29	-33	-33	-45	-47	-48	--	Total Apparent SRI
D _{2m,r,T}	-32	-36	-36	-48	-50	-51	--	Total Standardized Difference
Room Correction	3	3	3	3	3	3	--	Room Absorption Correction
Sound Level	42	35	35	24	19	11	34	Daytime L _{Aeq,16 hour} Value

Notes	
1	Evaluation based on calculation methodology of BS EN 12354-3:2017 "Estimation of acoustic performance of buildings from the performance of elements- Part 3: Airborne Sound Insulation Against Outdoor Sound"
2	Measured noise data for first floor and Architect's general arrangement drawing.



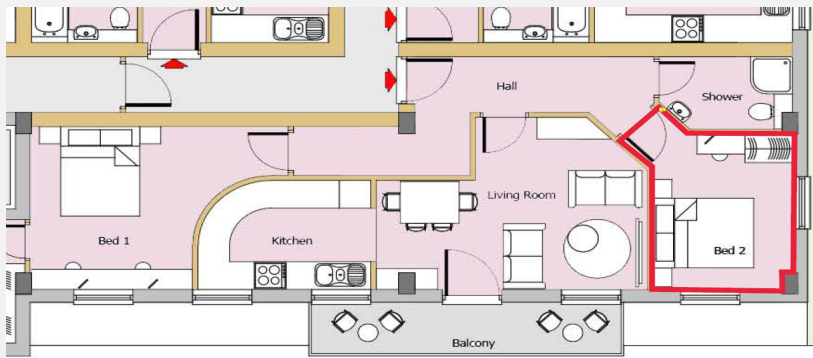
Calculation Sheet		First Floor, 2 Bed Apartment Overlooking Rockingham Road			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	5.85	2.83	3.07	8.83	24.99



Term	Description	Units	Value
Sf	Total façade area	m ²	16.6
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	3.1
Sew	External Wall Area	m ²	13.5
V	Volume of receiving room	m ³	25.0
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.0

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Leq,ff, Night-time	62	58	58	59	56	49	62	L _{Aeq,8hour} value
Ventilator, Dne	40	38	32	47	54	48	41	High Performance Acoustic Trickle Vent
Window SRI, Rwi	22	27	35	42	41	48	38	High Performance Acoustic Glazing
Solid Wall SRI, Rew	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R'w	-29	-33	-33	-45	-47	-48	--	Total Apparent SRI
D _{2m,r,T}	-32	-36	-36	-48	-50	-51	--	Total Standardized Difference
Room Correction	3	3	3	3	3	3	--	Room Absorption Correction
Sound Level	39	31	31	20	15	7	30	Night-time L _{Aeq,8 hour} Value

Notes	
1	Evaluation based on calculation methodology of BS EN 12354-3:2017 "Estimation of acoustic performance of buildings from the performance of elements- Part 3: Airborne Sound Insulation Against Outdoor Sound"
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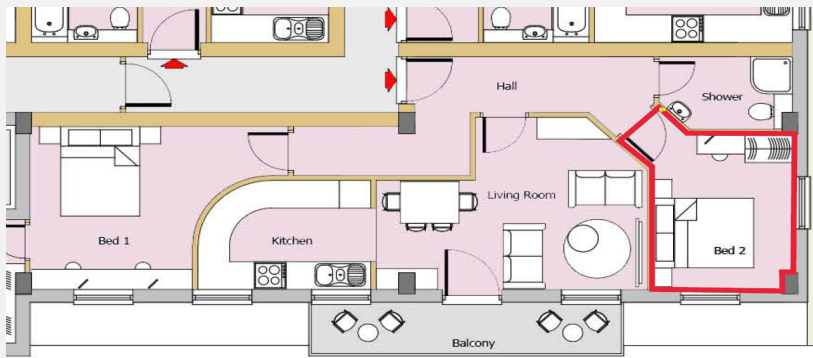
Calculation Sheet		First Floor, 2 Bed Apartment Overlooking Rockingham Road			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	5.85	2.83	3.07	8.83	24.99



Term	Description	Units	Value
Sf	Total façade area	m ²	16.6
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	3.1
Sew	External Wall Area	m ²	13.5
V	Volume of receiving room	m ³	25.0
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.0

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
L _{Amax,fast,ff} , Night-time	72	73	71	70	66	61	74	L _{Amax,fast} value
Ventilator, D _{ne}	40	38	32	47	54	48	41	High Performance Acoustic Trickle Vent
Window SRI, R _{wi}	22	27	35	42	41	48	38	High Performance Acoustic Glazing
Solid Wall SRI, R _{ew}	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R' _w	-29	-33	-33	-45	-47	-48	--	Total Apparent SRI
D _{2m,r,T}	-32	-36	-36	-48	-50	-51	--	Total Standardized Difference
Room Correction	3	3	3	3	3	3	--	Room Absorption Correction
Sound Level	49	46	44	31	25	19	43	Night-time L _{Amax,fast} Value

Notes	
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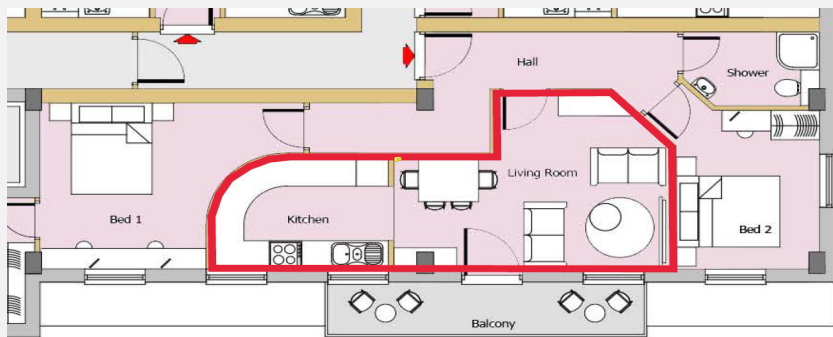
Calculation Sheet		First Floor, 2 Bed Apartment Overlooking Rockingham Road			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	8.36	2.83	7.08	21.70	61.41



Term	Description	Units	Value
Sf	Total façade area	m ²	23.7
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	7.1
Sew	External Wall Area	m ²	16.6
V	Volume of receiving room	m ³	61.4
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	19.8

Term	Octave Band Values						Overall Level dB(A) / R _{eq} / D _{now}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Leq,ff, Daytime	65	62	62	63	60	53	66	L _{Aeq,16hour} value
Ventilator, Dne	40	38	32	47	54	48	41	High Performance Acoustic Trickle Vent
Window SRI, Rwi	22	27	35	42	41	48	38	High Performance Acoustic Glazing
Solid Wall SRI, Rew	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R'w	-27	-32	-34	-45	-46	-49	--	Total Apparent SRI
D _{2m,r,T}	-28	-32	-35	-45	-46	-49	--	Total Standardized Difference
Room Correction	1	1	1	1	1	1	--	Room Absorption Correction
Sound Level	42	34	31	22	18	8	32	Daytime L _{Aeq,16 hour} Value

Notes	
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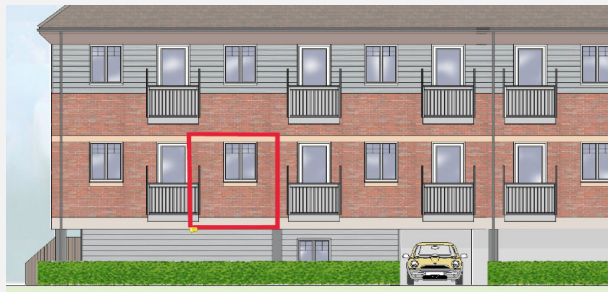
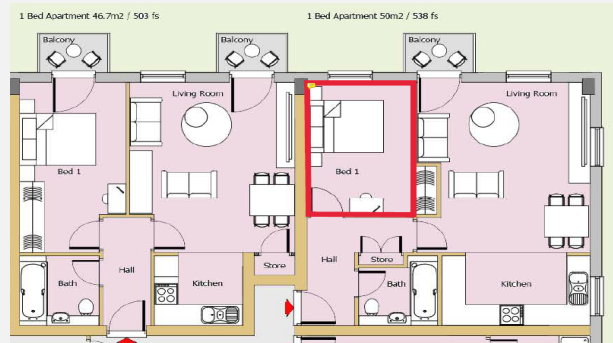
Calculation Sheet		First Floor, 1 Bed Apartment Overlooking Rockingham Wharf			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	2.59	2.83	1.46	9.50	26.89



Term	Description	Units	Value
Sf	Total façade area	m ²	7.3
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	1.5
Sew	External Wall Area	m ²	5.9
V	Volume of receiving room	m ³	26.9
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.7

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
L _{Aeq,ff} , Daytime	53	52	53	53	56	55	61	L _{Aeq,1hour} (incl character correction)
Ventilator, D _{ne}	36	38	36	32	27	39	35	Standard Acoustic Trickle Vent
Window SRI, R _{wi}	21	17	25	35	37	31	29	Standard Thermal Double Glazing
Solid Wall SRI, R _{ew}	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R' _w	-27	-24	-30	-30	-26	-35	--	Total Apparent SRI
D _{2m,r,T}	-26	-23	-29	-29	-25	-34	--	Total Standardized Difference
Room Correction	-1	-1	-1	-1	-1	-1	--	Room Absorption Correction
Sound Level	28	31	25	25	33	22	35	Daytime L _{Aeq,1hour} Value

Notes	
1	Evaluation based on calculation methodology of BS EN 12354-3:2017 "Estimation of acoustic performance of buildings from the performance of elements- Part 3: Airborne Sound Insulation Against Outdoor Sound"
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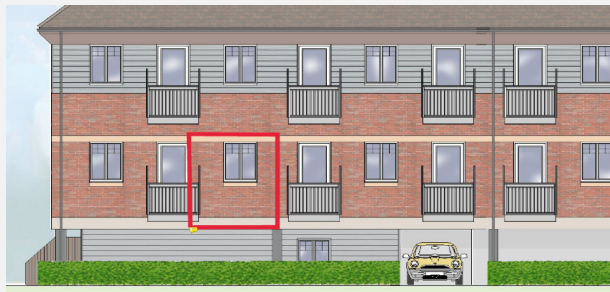
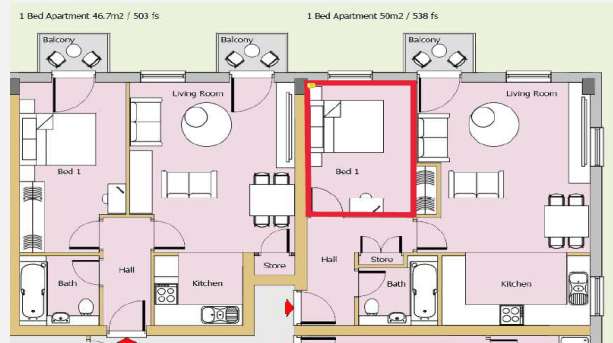
Calculation Sheet		First Floor, 1 Bed Apartment Overlooking Rockingham Wharf			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	2.59	2.83	1.46	9.50	26.89



Term	Description	Units	Value
Sf	Total façade area	m ²	7.3
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	1.5
Sew	External Wall Area	m ²	5.9
V	Volume of receiving room	m ³	26.9
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.7

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
L _{Aeq,ff} , Daytime	56	53	51	50	47	41	55	L _{Aeq,16hour}
Ventilator, Dne	36	38	36	32	27	39	35	Standard Acoustic Trickle Vent
Window SRI, Rwi	21	17	25	35	37	31	29	Standard Thermal Double Glazing
Solid Wall SRI, Rew	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R'w	-27	-24	-30	-30	-26	-35	--	Total Apparent SRI
D _{2m,r,T}	-26	-23	-29	-29	-25	-34	--	Total Standardized Difference
Room Correction	-1	-1	-1	-1	-1	-1	--	Room Absorption Correction
Sound Level	31	32	23	22	24	8	29	Daytime L _{Aeq,16hour} Value

Notes	
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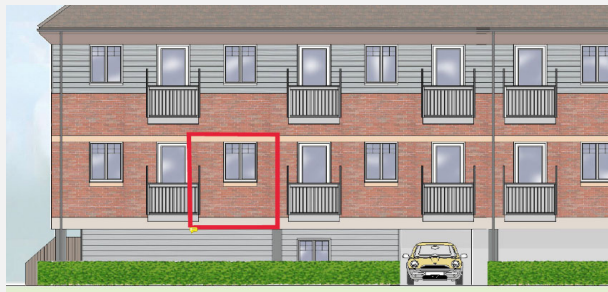
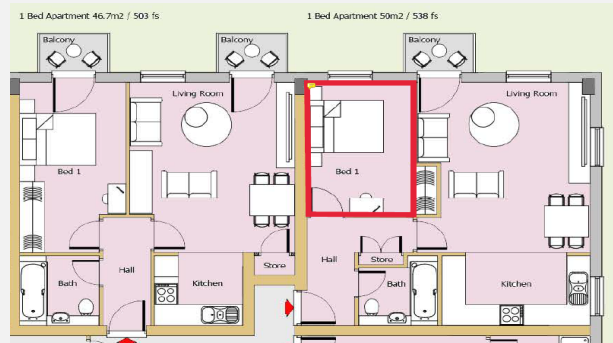
Calculation Sheet		First Floor, 1 Bed Apartment Overlooking Rockingham Wharf			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	2.59	2.83	1.46	9.50	26.89



Term	Description	Units	Value
Sf	Total façade area	m ²	7.3
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	1.5
Sew	External Wall Area	m ²	5.9
V	Volume of receiving room	m ³	26.9
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.7

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
L _{Aeq,ff} , Night-time	52	49	47	46	45	37	51	L _{Aeq,8hour}
Ventilator, D _{ne}	36	38	36	32	27	39	35	Standard Acoustic Trickle Vent
Window SRI, R _{wi}	21	17	25	35	37	31	29	Standard Thermal Double Glazing
Solid Wall SRI, R _{ew}	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R' _w	-27	-24	-30	-30	-26	-35	--	Total Apparent SRI
D _{2m,r,T}	-26	-23	-29	-29	-25	-34	--	Total Standardized Difference
Room Correction	-1	-1	-1	-1	-1	-1	--	Room Absorption Correction
Sound Level	27	28	19	18	22	4	26	Night-time L _{Aeq,8hour} Value

Notes	
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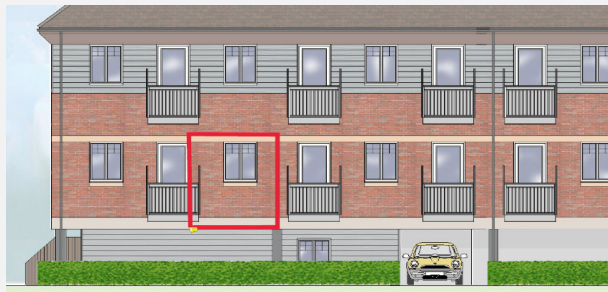
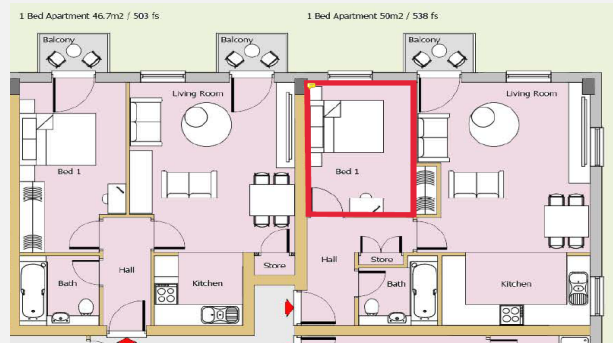
Calculation Sheet		First Floor, 1 Bed Apartment Overlooking Rockingham Wharf			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Bedroom	2.59	2.83	1.46	9.50	26.89



Term	Description	Units	Value
Sf	Total façade area	m ²	7.3
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	1.5
Sew	External Wall Area	m ²	5.9
V	Volume of receiving room	m ³	26.9
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	8.7

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
L _{Amax,fast,ff} , Night-time	61	56	56	61	60	54	65	L _{Amax,fast} value
Ventilator, Dne	36	38	36	32	27	39	35	Standard Acoustic Trickle Vent
Window SRI, R _{wi}	21	17	25	35	37	31	29	Standard Thermal Double Glazing
Solid Wall SRI, R _{ew}	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R' _w	-27	-24	-30	-30	-26	-35	--	Total Apparent SRI
D _{2m,r,T}	-26	-23	-29	-29	-25	-34	--	Total Standardized Difference
Room Correction	-1	-1	-1	-1	-1	-1	--	Room Absorption Correction
Sound Level	36	35	28	33	37	21	39	Night-time L _{Amax,fast} Value

Notes	
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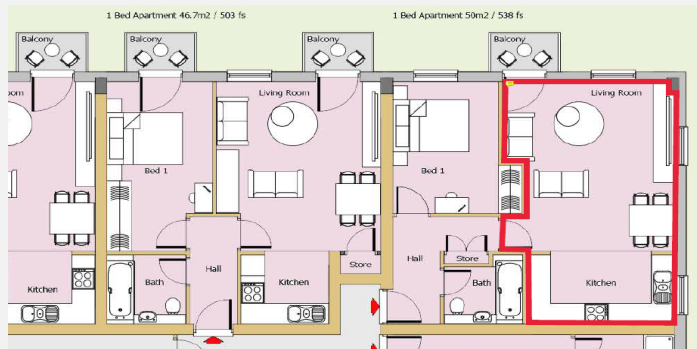
Calculation Sheet		First Floor, 1 Bed Apartment Overlooking Rockingham Wharf			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Living Room	11.07	2.83	7.08	25.60	72.45



Term	Description	Units	Value
Sf	Total façade area	m ²	31.3
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	7.1
Sew	External Wall Area	m ²	24.2
V	Volume of receiving room	m ³	72.4
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	23.3

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Leq,ff, Daytime	53	52	53	53	56	55	61	L _{Aeq,1hour} value (incl. character penalty)
Ventilator, Dne	36	38	36	32	27	39	35	Standard Acoustic Trickle Vent
Window SRI, Rwi	21	17	25	35	37	31	29	Standard Thermal Double Glazing
Solid Wall SRI, Rew	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R'w	-27	-23	-31	-36	-32	-37	--	Total Apparent SRI
D _{2m,r,T}	-28	-25	-32	-37	-33	-38	--	Total Standardized Difference
Room Correction	1	1	1	1	1	1	--	Room Absorption Correction
Sound Level	30	33	26	22	29	23	33	Daytime L _{Aeq,16 hour} Value

Notes	
1	Evaluation based on calculation methodology of BS EN 12354-3:2017 "Estimation of acoustic performance of buildings from the performance of elements- Part 3: Airborne Sound Insulation Against Outdoor Sound"
2	Measured noise data for first floor and Architect's general arrangement drawing.



Calculation Sheet		First Floor, 1 Bed Apartment Overlooking Rockingham Wharf			
Room Type	Façade Dimensions		Window Dimensions	Room Area	Volume
	W (m)	H (m)	Areas (m ²)	m ²	m ³
Living Room	11.07	2.83	7.08	25.60	72.45



Term	Description	Units	Value
Sf	Total façade area	m ²	31.3
Svents	Vents Equivalent Open Area	m ²	0.005
Swi	Window Area	m ²	7.1
Sew	External Wall Area	m ²	24.2
V	Volume of receiving room	m ³	72.4
T	Rev. Time of Receiving room (residential room ISO 140)	sec.	0.5
A ₀	Reference Abs Area	m ²	10
A	Equivalent Abs Area (receiving room)	m ²	23.3

Term	Octave Band Values						Overall Level dB(A) / R _w / D _{new}	Description
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Leq,ff, Daytime	56	53	51	50	47	41	55	L _{Aeq,16hour} value
Ventilator, Dne	36	38	36	32	27	39	35	Standard Acoustic Trickle Vent
Window SRI, Rwi	21	17	25	35	37	31	29	Standard Thermal Double Glazing
Solid Wall SRI, Rew	41	43	48	50	55	55	50	Brick Block Cavity Wall
Composite R'w	-27	-23	-31	-36	-32	-37	--	Total Apparent SRI
D _{2m,r,T}	-28	-25	-32	-37	-33	-38	--	Total Standardized Difference
Room Correction	1	1	1	1	1	1	--	Room Absorption Correction
Sound Level	33	34	24	19	20	9	28	Daytime L _{Aeq,16 hour} Value

Notes	
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