



17-27 QUEEN
VICTORIA STREET
READING RG1

External Building
Fabric Report

REPORT 7845/EBF/Rev1
Prepared: 27 March 2017
Revision Number: 0

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External Building Fabric Report



17-27 QUEEN VICTORIA STREET
READING, RG1

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Revision	Comment	Date	Prepared By	Approved By
Zero	First issue of report	24 February 2017	Carl Ruegger	David Johnston
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1.0 INTRODUCTION

The re-development of 17-27 Queen Victoria Street, Reading, RG1 is proposed. The office space is to be converted in to residential accommodation comprising 19 flats.

The site is located in central Reading with the pedestrianised Queen Victoria Street to the east and a court yard to the west. Please also see attached Site Plan 7845/SP1. An assessment has been carried out in relation to the noise levels likely to be incident on the proposed building façades and to provide acoustic performance specifications such that acceptable internal noise criteria can be achieved.

This report details the results of the noise survey and sets out the acoustic performance requirements of the external building fabric elements. In addition, suitable plant noise emission criteria have also been developed based upon the survey results and the likely requirements of the Local Authority.

This report is based upon application drawings and details and is suitable for submission with the planning application.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

Monitoring of the prevailing background noise was undertaken over the following 48 hour period:

13:00 Wednesday 15 February to 13:00 Friday 17 February 2017

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period, however the weather was generally considered satisfactory it being predominantly dry with little wind.

Measurements were made of the L_{A90} , L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes duration.

2.2 Measurement Locations

To determine the existing noise climate around the site measurements were undertaken at the following locations.

Position 1

Measurements were taken at the front of the building overlooking Queen Victoria Street. The microphone was attached to an A-frame and positioned out of a 2nd floor window. The results at this measurement location are considered to be subject to façade reflection effects. The measurement position is also illustrated on the attached Site Plan 7845/SP1.

The prevailing noise climate was noted to mainly consist of pedestrian traffic noise on Queen Victoria Street and road traffic on the surrounding road network.

Position 2

Measurements were taken at the rear of the building overlooking a court yard. The microphone was attached to an A-frame and positioned out of a 3rd floor window. The measurements are considered to be affected by façade reflections. The measurement position is also illustrated on the attached Site Plan 7845/SP1.

The prevailing noise climate was noted to be quiet mainly consisting of plant noise and noise from the surrounding traffic network.

2.3 Instrumentation

The following equipment was used for the measurements:

Table 7845/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1406262	471261961	17 March 2017
Norsonic Pre Amplifier	1209	20487		
Norsonic ½" Microphone	1225	225566		
Norsonic Sound Calibrator	1251	34429	CAL 022-2015-5348	20 May 2017
Norsonic Type 1 Sound Level Meter	Nor140	1406407	474294132	30 September 2017
Norsonic Pre Amplifier	1209	20688		
Norsonic ½" Microphone	1225	226839		
Norsonic Sound Calibrator	1251	34482	CAL 022-2015-5523	3 September 2017

The sound level meters were calibrated both prior to and on completion of the survey with no calibration drifts observed.

2.4 Results

The measured L_{Aeq} , L_{A90} and L_{Amax} 15 minute period levels are shown as time-histories on the attached Graphs 7845/G1-4. The averaged (façade reflection corrected) daytime and night-time L_{Aeq} noise levels are summarised in the following Table 7845/T2 below.

Table 7845/T2 – Façade Incident L_{Aeq} Noise Levels

Measurement Position	Average (façade reflection corrected) $L_{Aeq, period}$ Noise Level (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1 – Front	59	62
Position 2 – Rear	47	39

The minimum background noise levels ($L_{A90,15\text{mins}}$) at each measurement position are summarised in the following Table 7845/T3 below. This data can be used to set plant noise emission criteria for use in the assessment of noise emissions from any proposed plant at the development.

Table 7845/T3 – Measured Minimum $L_{A90,15\text{mins}}$ Noise Levels

Measurement Position	Minimum $L_{A90,15\text{mins}}$ Noise Level during period (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1 – Front	46	41
Position 2 – Rear	39	38

Averaged spectral noise levels are graphically represented on the attached Graphs 7845/G5-6.

2.5 Discussion

It is noted that on the front façade the measured L_{Aeq} noise levels were higher during the night time than the day time. This is most likely due to a combination of pedestrian noise and deliveries to the shops on Queen Victoria Street taking place over the night time period. We consider these measurements to be valid and they will be used in our assessment going forward.

3.0 PLANT NOISE EMISSION CRITERIA

The requirements of the Local Authority with regards to plant noise emissions are not currently known. However, given the prevailing noise climate we propose a noise level limit of 10dB below the background L_{A90} for all operating plant at 1m from the nearest noise sensitive façade. In line with this we would propose items of mechanical services are designed, such that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise sensitive location:

Table 7845/T4 – Plant Noise Emission Limits

Measurement Position	L_{Aeq} Noise Level limit of all operating plant (dB) at 1m from the nearest noise sensitive façade	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1 – Front	36	31
Position 2 – Rear	29	28

In line with BS 4142, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be applied to any of the above proposed noise emission limits in Table 7845/T4.

4.0 EXTERNAL BUILDING FABRIC CRITERIA

This section outlines the assessment criteria we anticipate the Local Authority will require in terms of the relevant standards, although some relaxation to internal ambient conditions may be agreed to the building's listed status. A brief explanation of the acoustic terminology used in this report is shown within Appendix A.

4.1 British Standard 8233:2014

BS 8233:2014 Guidance on Sound insulation and noise reduction for buildings draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions.

The noise level values given are in terms of an average (L_{Aeq}) level.

The standard advises the following internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties. A brief explanation of the acoustic terminology used in this report is shown in Appendix A attached.

Table 7845/T5 – BS 8233:2014 Residential Criteria

Room	07:00 to 23:00	23:00 to 07:00
Living Rooms	35 dB $L_{Aeq,16hour}$	--
Dining Room/area	40 dB $L_{Aeq,16hour}$	--
Bedrooms	35dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.2 World Health Organisation: Guidelines for Community Noise

The document describes guideline levels that are “essentially values for the onset of health effects from noise exposure”.

A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure.

The following is an extract from Table 4.1: Guideline values for community noise in specific environments, as stated in the document.

Table 7845/T6 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

With reference to maximum noise levels the following guidance is provided within the WHO guidance:

“For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991) and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10-30s, SEL values of 55-60 corresponds to a L_{Amax} value of 45dB. Ten to 15 of these events during an 8 hour night-time implies a $L_{Aeq, 8h}$ of 20-25dB. This is 10-15dB below the $L_{Aeq, 8h}$ or 30dB for continuous night-time noise exposure, and shows that intermittent character of noise must be taken into account when setting night-time noise limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background of these events.”

Therefore the frequency of occurrence of maximum noise events should not typically exceed 10-15 times in any night.

4.3 Summary

The project criteria adopted are therefore as follows;

Bedroom	Night-time (23:00-07:00)	30dB L_{Aeq} 45dB $L_{Amax,f}$ (typical)
Living Rooms	Daytime (07:00-23:00)	35dB L_{Aeq}

5.0 EXTERNAL BUILDING FABRIC ASSESSMENT

5.1 Background

Appropriate internal noise levels can be achieved providing suitable building envelope constructions are employed.

Analyses of the external building fabric have been undertaken in order to ascertain the required acoustic performance of the glazing and other external fabric elements to achieve the project criteria.

5.2 Assumptions

Our external building fabric analyses have assumed the following:

(a) Drawings

Our assessment has been based on the following Scenario Architect's proposed drawings.

Drawing Number	Description	Date
PR-A1.03	First Floor Plan	20.02.2017
PR-A1.04	Second Floor Plan	17.01.2017
PR-A1.05	Third Floor Plan	17.01.2017

(b) Noise Levels

The assessment has been based on the measured noise levels as detailed in Section 2.4.

(c) Room Absorption

We have assumed the bedrooms to be acoustically “soft” with carpets, curtains and other soft furnishings. For the purposes of our analyses we have assumed the following absorption coefficients.

Table 7845/T7 – Bedroom Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.25	0.27	0.31	0.32	0.32	0.32

We have assumed the living rooms to be less acoustically absorptive (with a hard floor finish, although with furnishings). For the purposes of our analyses we have assumed the following absorption coefficients:

Table 7845/T8 – Living Room Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.20	0.22	0.22	0.22	0.23	0.27

(d) External Wall

We understand that existing external non-glazed areas comprise a brick construction which will likely be thermally lined internally, although the extent of the linings will depend on other considerations such as listed status. As such, we have assumed the following sound reduction indices (equating to an overall R_w of 52dB) for all non-glazed façade areas comprising the above construction:

Table 7845/T9 – Non-Glazed SRIs

Assumed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
36	41	45	45	54	58	58	58

Should the proposals for non-glazed areas change, it is critical we are informed at the earliest opportunity as this could have a significant impact on the sound insulation performance requirements of the glazing systems.

(e) Glazing

Due to the listed status of the building it is proposed to install secondary glazing to the front façade of the property. Existing windows and frames should be refurbished to a high standard and any seals made good.

(f) Ventilation

The proposed ventilation strategy is mechanical ventilation with heat recovery (MVHR) and no un-ducted (through-the-frame/wall) trickle ventilators will be required.

It should be noted that MVHR systems provide background trickle ventilation only and that windows are to generally be openable to provide rapid ventilation. During those periods where windows are opened for purge / rapid ventilation, noise levels will naturally be increased internally.

5.3 Specification & Guidance Constructions

Appendix B (attached) details the sound reduction performance specification for the glazed elements of the external building fabric.

The glazing performance specifications apply to the glazing package as a whole inclusive of glazing, louvres, spandrel panels, framing, opening lights, doors, seals, etc. The performance of the glazing system will depend on many factors such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc.

For guidance purposes we would typically expect the following glazing configurations detailed below to prove commensurate with achieving the sound insulation performance specifications detailed within Appendix B.

Please note – The glazing configurations described in Table 7845/T10 are given for costing purposes only. All window systems should be capable of meeting the performance specifications shown in Appendix B, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a window configuration will meet the performance specification.

Table 7845/T10 – Glazing Guidance Constructions

Glazing Type	Glazing Configuration
G1	Secondary glazing comprising existing glazing / min 100mm cavity / single pane of differing thickness
G2	Any standard double glazing with differing pane thickness

5.4 Applicable Zoning

Due to the differences in the prevailing noise climate around the site and the types of rooms at each floor level, two primary glazing zones have been defined, as indicated on the attached Façade Zoning Plans 7845/FZP1-3.

- | | | | | |
|------|--------|---|---------------|----|
| (i) | Zone 1 | – | Glazing Type: | G1 |
| (ii) | Zone 2 | – | Glazing Type: | G2 |

6.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site at 17-27 Queen Victoria Street, Reading. The measured noise levels are presented herein. The resultant noise levels have been used in our assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233, WHO and anticipated Local Authority requirements.

The data has also been used to set plant noise emission criteria for future assessment of any proposed plant at the development to ensure the adjacent neighbour's amenity spaces are protected from plant noise emissions in line with anticipated Local Authority requirements.

We therefore do not consider planning approval should be refused on the basis of noise.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10} , L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – External Building Fabric Acoustic Specification

1.0 Window Sound Insulation Performance

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc. as appropriate) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 10140-2:2010:

Type	Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								R _w (dB)
	63	125	250	500	1k	2k	4k	8k	
G1	22	26	34	44	56	53	52	52	46
G2	16	20	19	23	32	35	35	35	29

Note: RW is the “overall weighted sound reduction index” tested in a laboratory.

N.B. as the internal noise criteria are expressed in dBA terms, other frequency-specific performance levels may ultimately prove acoustically acceptable. Test data for representative samples of all glazing systems shall be submitted to RBA Acoustics for approval to demonstrate compliance with the above performance specifications.

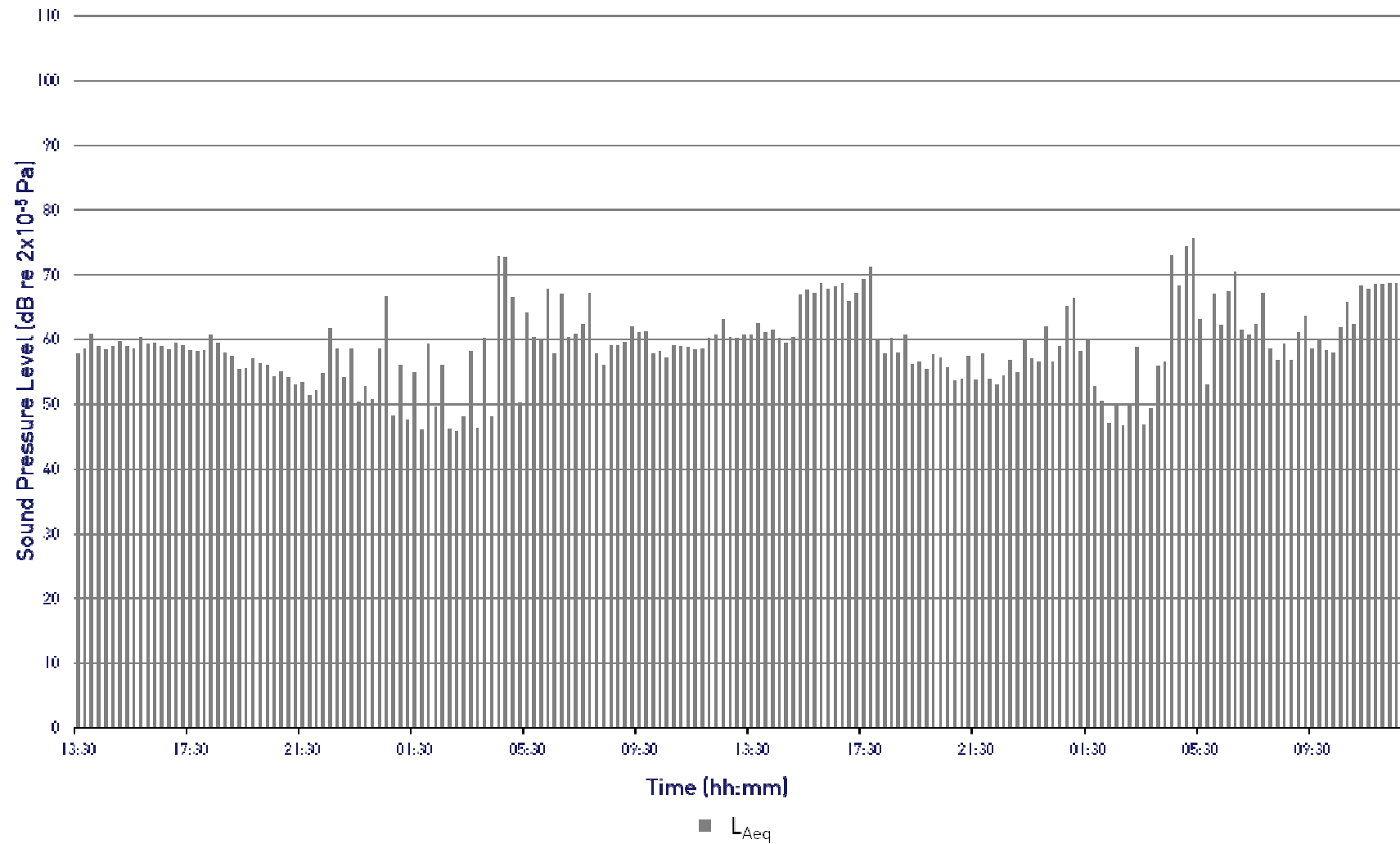
Queen Victoria Street, Reading

L_{Aeq} Time History

Measurement Position 1, Wednesday 15 February 2017 to Friday 17 February 2017



Graph 7845/G1



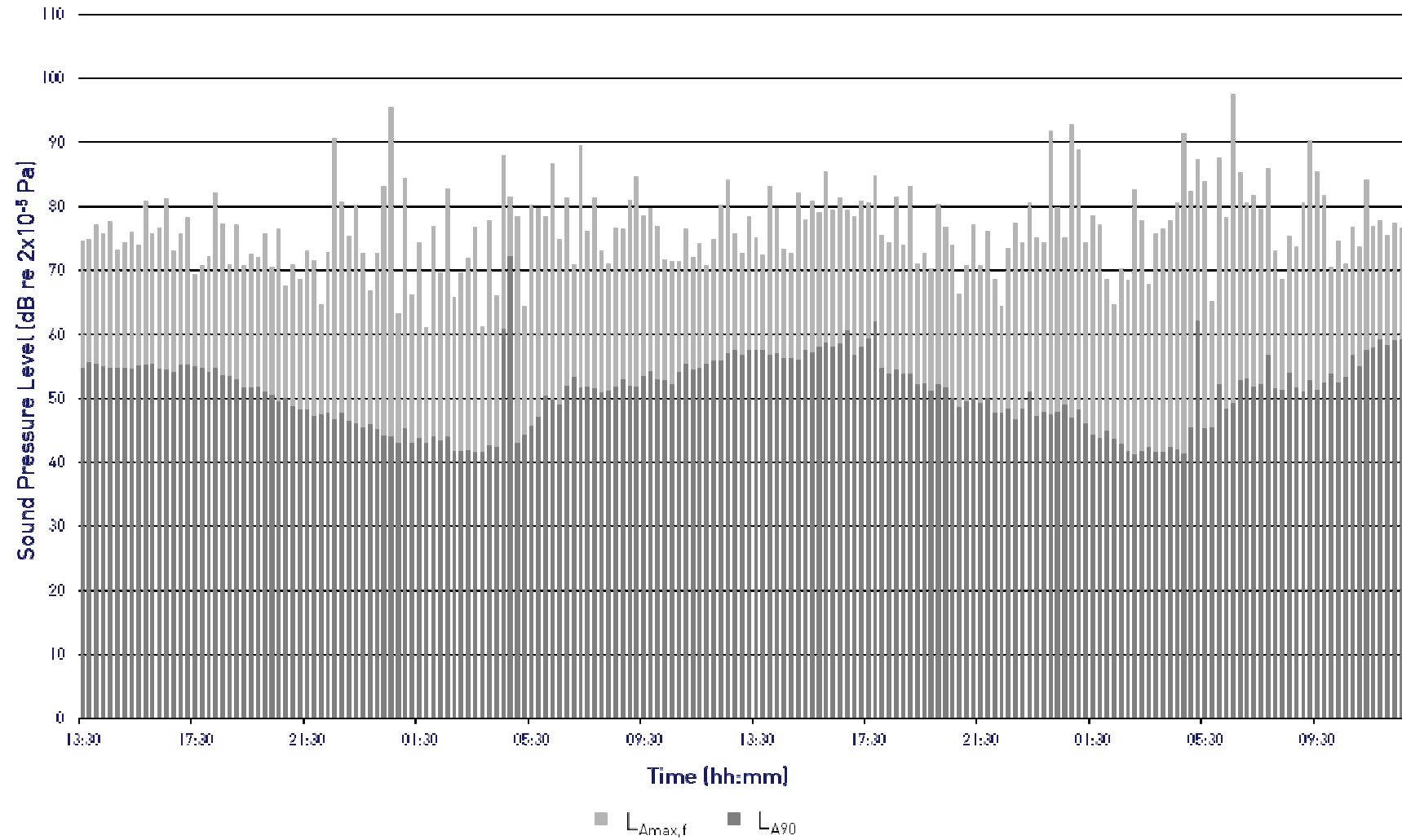
Queen Victoria Street, Reading

$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 1, Wednesday 15 February 2017 to Friday 17 February 2017



Graph 7845/G2



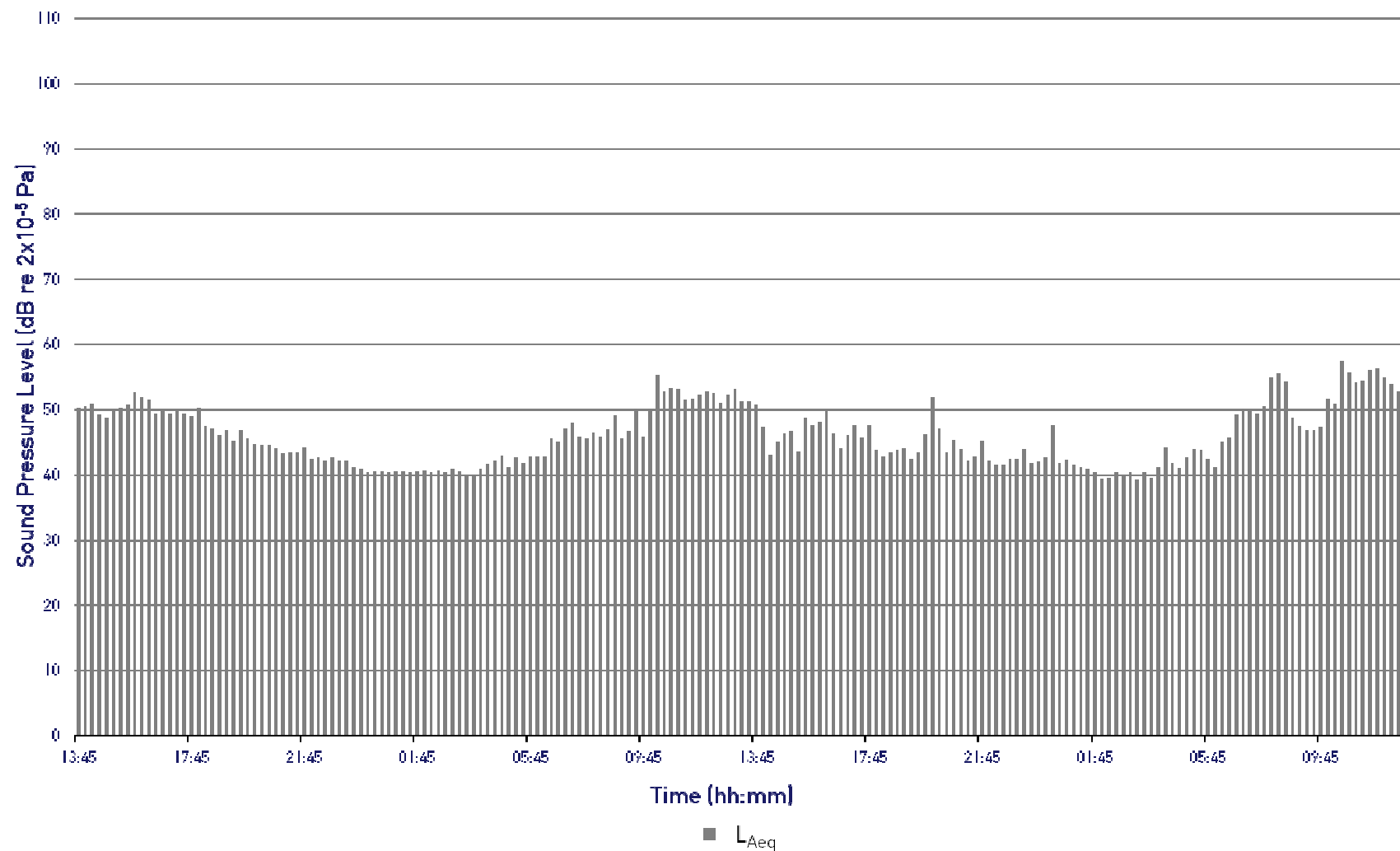
Queen Victoria Street, Reading

L_{Aeq} Time History

Measurement Position 2, Wednesday 15 February 2017 to Friday 17 February 2017



Graph 7845/G3



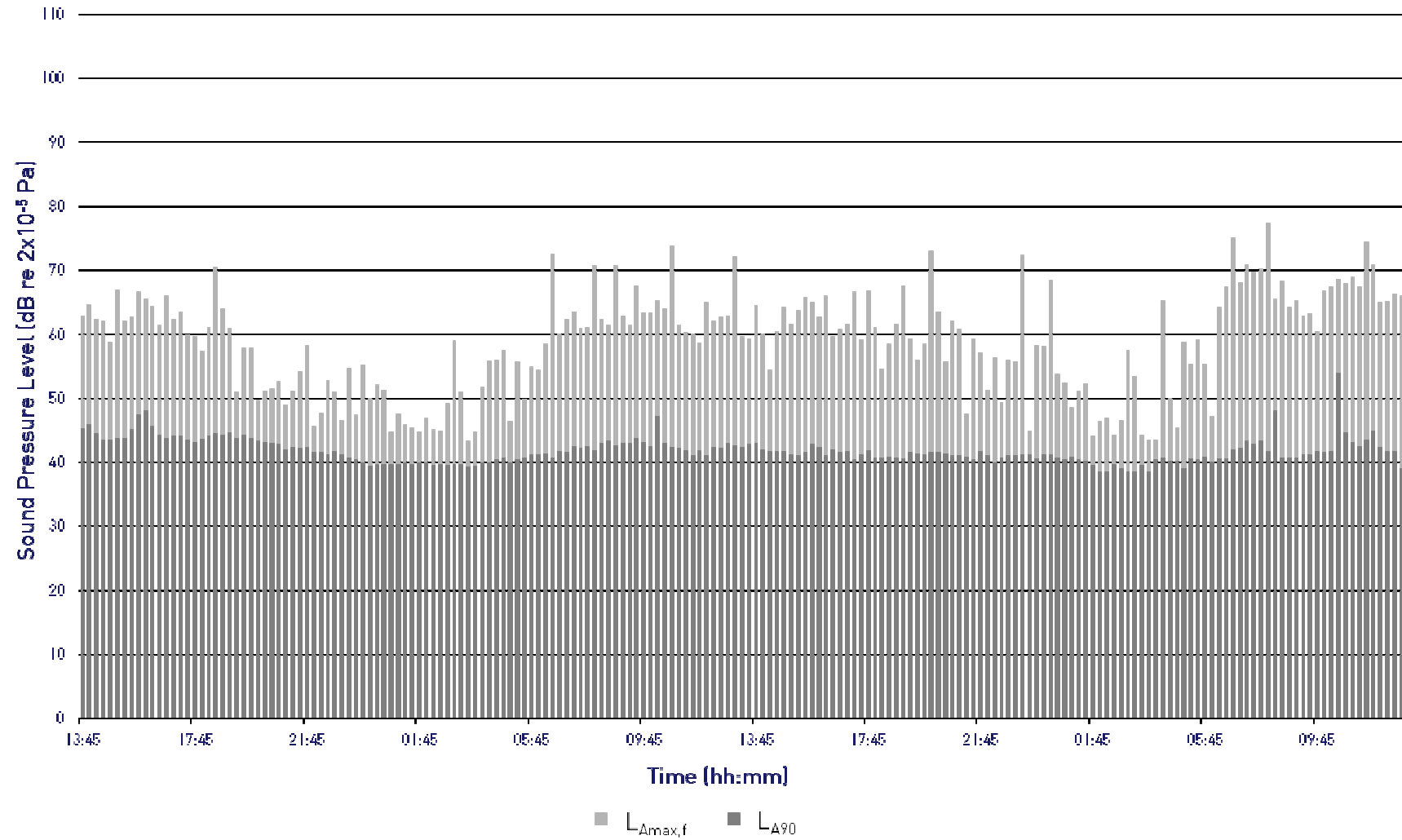
Queen Victoria Street, Reading

$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 2, Wednesday 15 February 2017 to Friday 17 February 2017



Graph 7845/G4



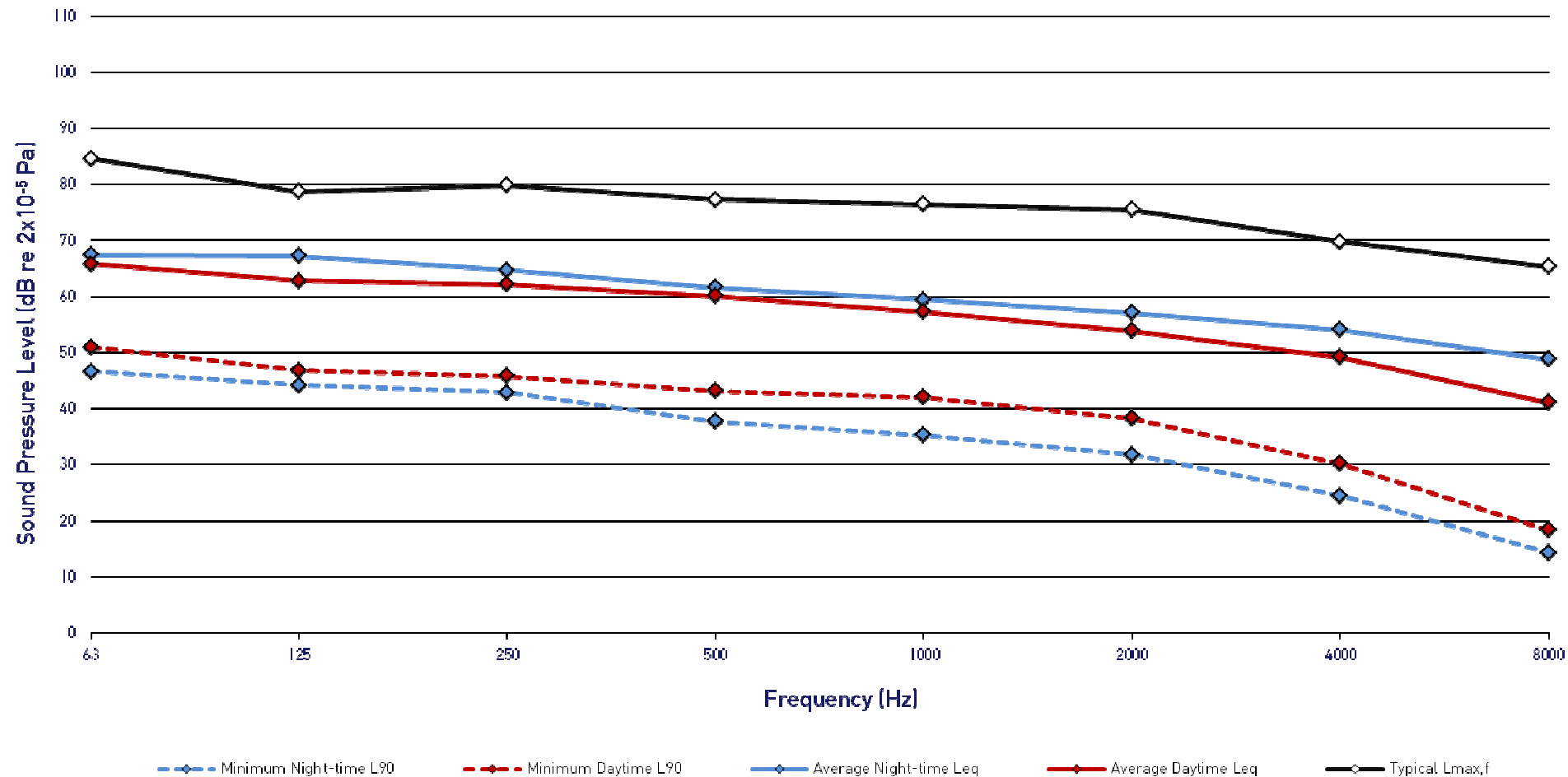
Queen Victoria Street, Reading

Spectral Noise Levels

Measurement Position 1, Wednesday 15 February 2017 to Friday 17 February 2017



Graph 7845/G5



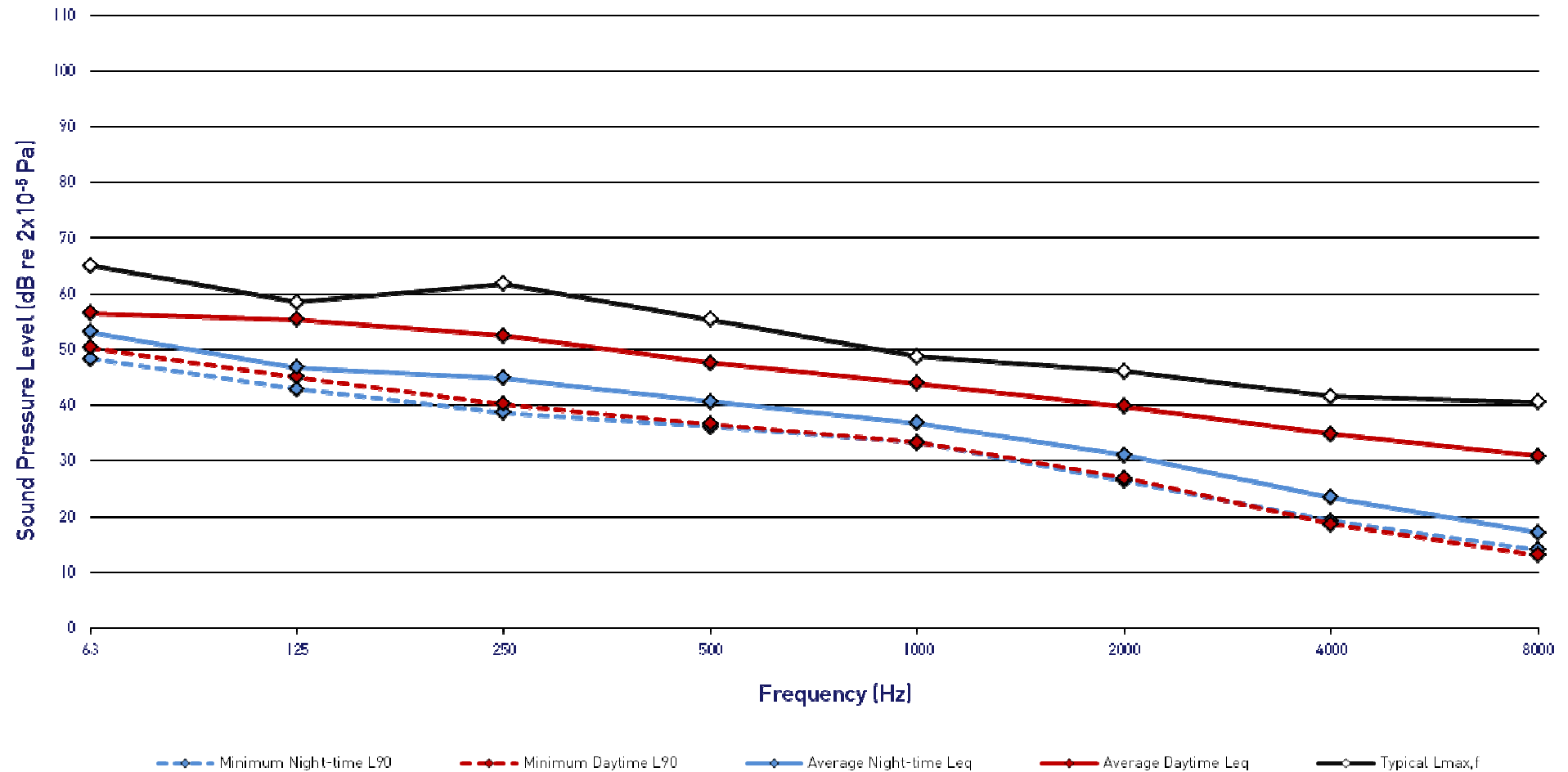
Queen Victoria Street, Reading

Spectral Noise Levels

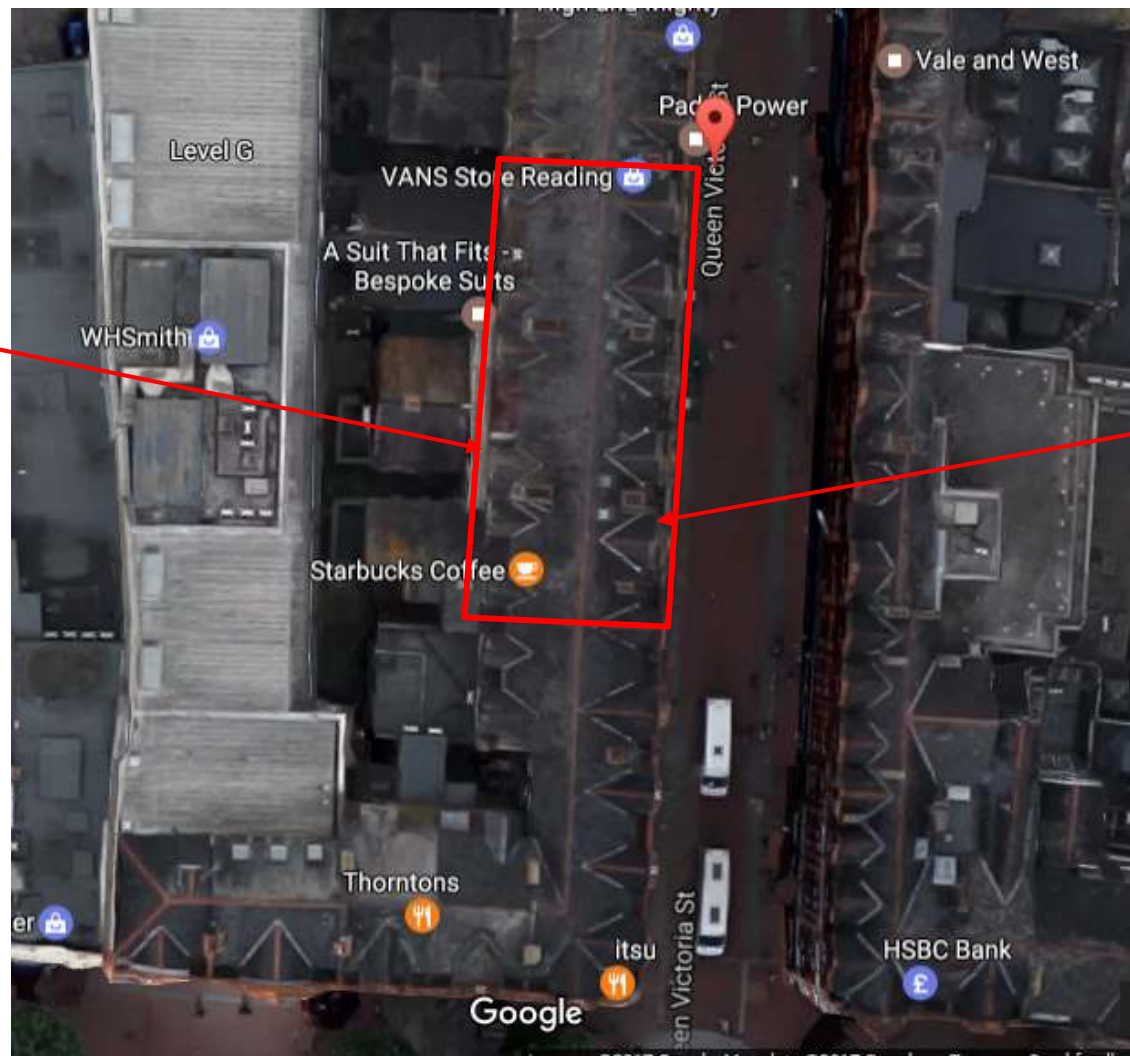
Measurement Position 2, Wednesday 15 February 2017 to Friday 17 February 2017



Graph 7845/G6



Position 2

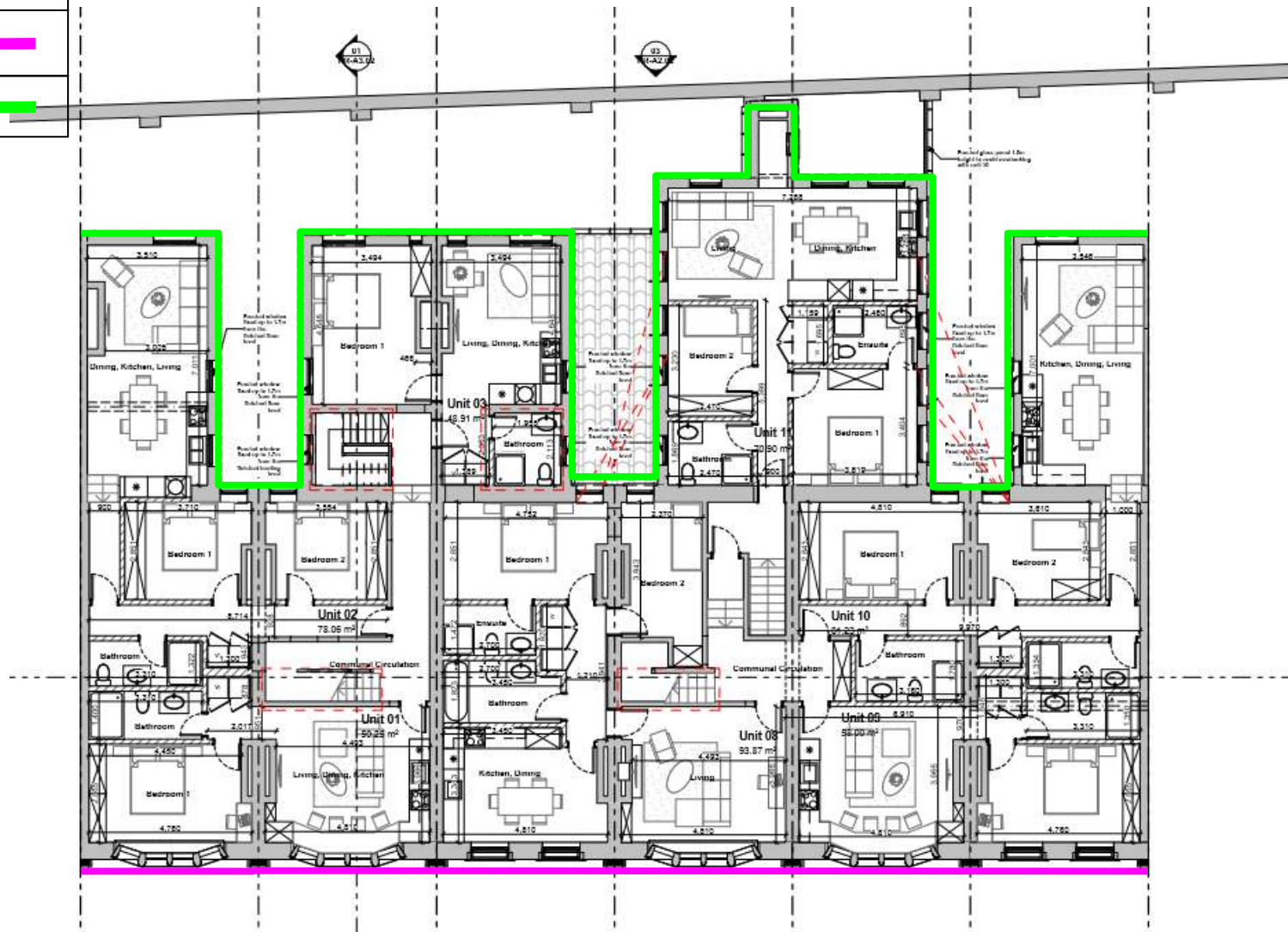


Position 1

Queen Victoria Street, Reading
Site Plan with Survey Measurement Position

Figure 7845/SP1
27 March 2017
Not to Scale

Key:	
Zone 1:	
Zone 2:	



Queen Victoria Street, Reading
Glazing Zones

Figure 7845/FZP1
27 March 2017
Not to Scale



Key:

Zone 1: 

Zone 2: 



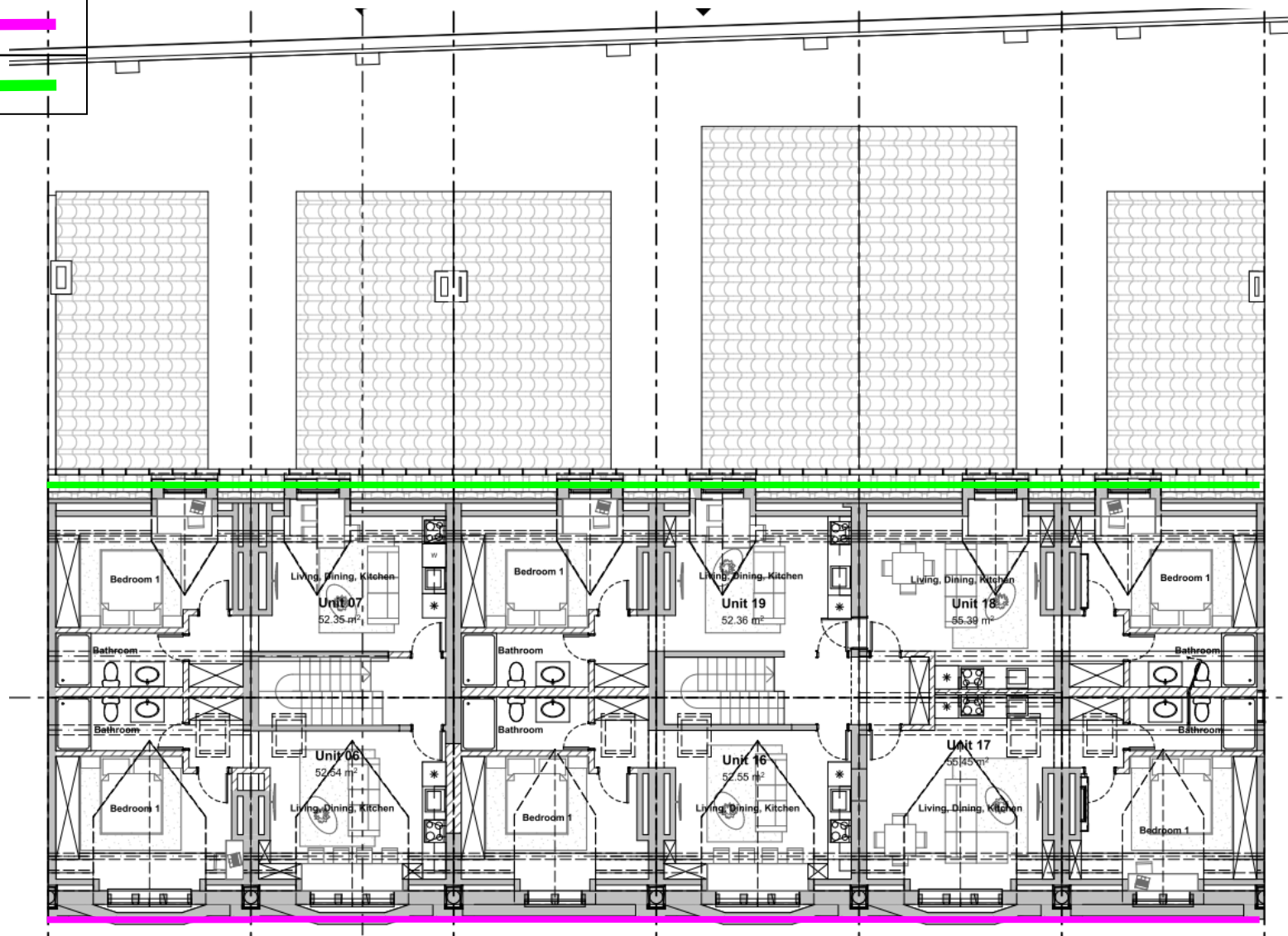
Queen Victoria Street, Reading
Glazing Zones

Figure 7845/FZP2
27 March 2017
Not to Scale

Key:

Zone 1: 

Zone 2: 



Queen Victoria Street, Reading
Glazing Zones

Figure 7845/FZP3
27 March 2017
Not to Scale

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