

**41 London Street,
Reading**

Noise Assessment for
Planning

14th May 2021



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1. INTRODUCTION

1.1. Overview

NRG Consulting has been commissioned to assess the impact of noise at 41 London Street, Reading, RG1 4PS in respect of the site's suitability for residential development.

The following technical noise assessment has been produced to provide supporting information to support a planning application to Reading Borough Council and is based upon environmental noise measurements undertaken at the site.

This noise assessment is necessarily technical in nature; therefore a glossary of terms is included in Appendix A to assist the reader.

1.2. Scope and Objectives

The scope of the noise assessment can be summarised as follows:

- A sound monitoring survey was undertaken at discrete locations around the Site;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the existing sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Practice Guidance in England: Noise¹ and BS8233:2014².

¹ Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.

² British Standard Institution. BS 8233:2014 Guidance on sound insulation and noise reduction for buildings.

2. ASSESSMENT FRAMEWORK

2.1. British Standards

2.1.1. BS8233:2014

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 guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guidance values, as detailed below in Table 1.

Table 1: BS8233:2014 Ambient Noise Levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS8233:2014 goes on to suggest that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

With regard to maximum noise levels, the standard identifies that regular individual noise events (such as passing trains or scheduled aircraft etc) can cause sleep disturbance. The standard does not provide a guideline design target, but simply goes on to suggest that a guideline value may be set in terms of SEL or $L_{Amax,F}$, depending upon the character and number of events per night. It goes on to suggest that more sporadic noise events could require separate values.

In respect of external noise levels, the guidance in BS8233:2014 suggests that *“it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments”*.

BS8233:2014 provides a much more detailed narrative on noise levels in external amenity areas and acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within these guideline values.

In respect of gardens and patios, BS8233:2014 states;

“...it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.”

BS8233: 2014 goes on to state, for 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”.

In respect of balconies, roof gardens and terraces, BS8233:2014 states; *“Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses; however, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas*

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

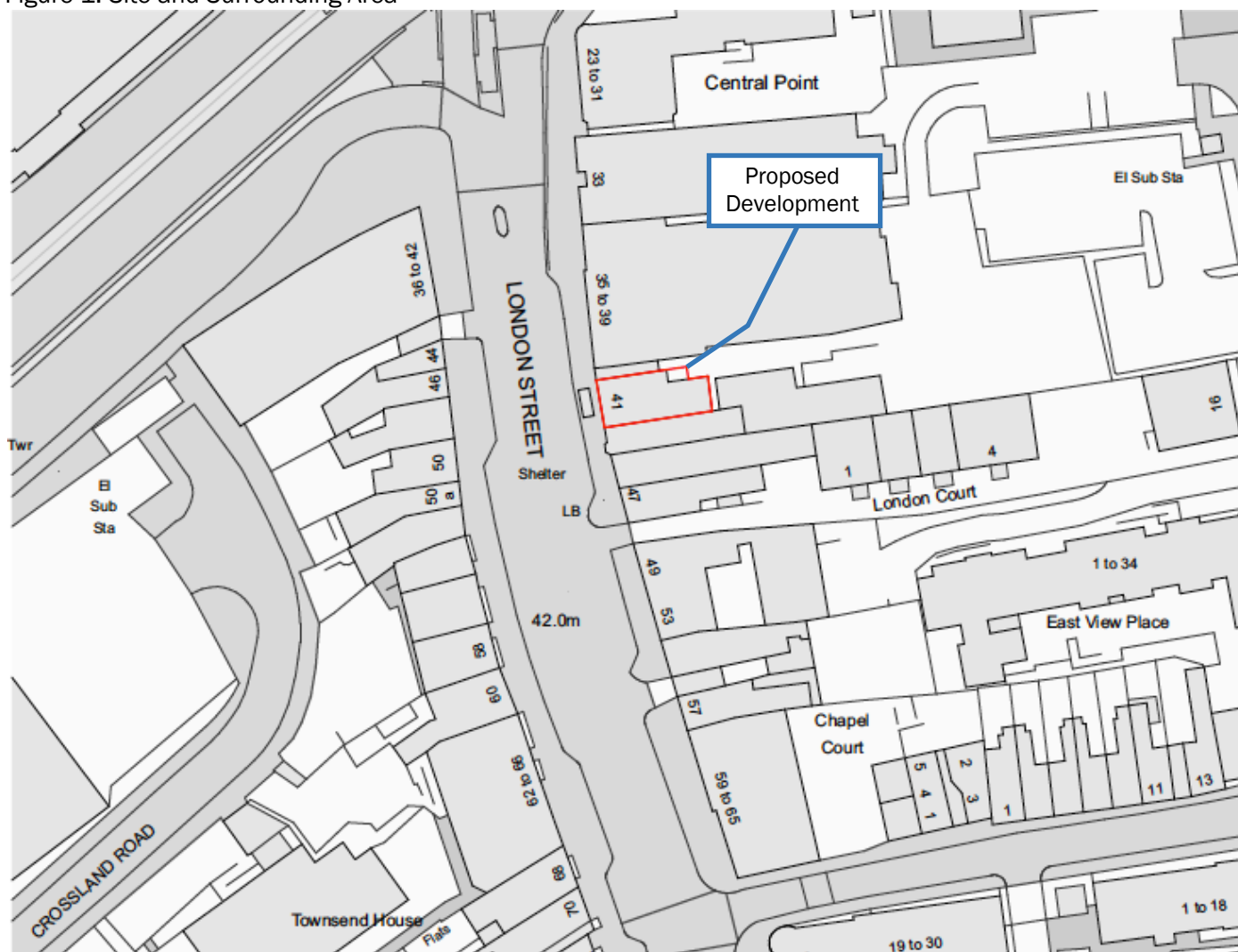
It is clear from the narrative of BS8233:2014, that proposed development within noisy environments should be designed to ensure that the recommended internal design standards are achieved, and that noise levels in external amenity areas are designed to effectively control and reduce noise levels, although it acknowledges that in certain circumstance meeting the external design recommendations may not be feasible, or necessary, especially where the provision of such spaces is desirable for other technical, planning or policy reasons.

3. SITE DESCRIPTION

The site is located at 41 London Street, Reading. The Development area can be seen in Figure 1, below.

The ambient sound environment within the Site was noted to be influenced by nearby road traffic, commercial activity on the high street and distant off-site commercial hum. Additionally, noise from pedestrians passing on London Street was also audible.

Figure 1: Site and Surrounding Area



3.1. Proposed Development Overview

The Proposed Development is a Change of Use from an existing office building to a 2-bed flat on the ground and basement floor, with an 8-bed HMO proposed on the first and second floor with a bedroom associated with the HMO located to the rear of the ground floor of the property. It is understood that the building is listed.

It is anticipated that the building façade is to be retained. It is proposed that the windows at the front of the building overlooking London Street will utilise secondary glazing along with acoustic trickle vents and will be openable for the purpose of purge ventilation. The windows to the rear of the building will retain the existing glazing.

Figure 2: Proposed Floor Plans



4. MEASUREMENT METHODOLOGY

4.1. General

The prevailing noise conditions in the area have been determined by an environmental noise survey conducted during both daytime and night-time periods between Wednesday 28th and Thursday 29th April 2021.

4.2. Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445³.

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672⁴. A full inventory of this equipment is shown in Table 2 below.

Table 2: Inventory of Sound Measurement Equipment

Unit	Make, Model & Description	Serial Number
MP1	Rion NL-52 Sound Level Meter	00764926
	Rion NH-25 Preamplifier	76427
	Rion UC-59 Microphone	12922
MP2	Svan 957 Sound Level Meter	21890
	Svantek SV 12L Preamplifier	24215
	ACO 7052E Microphone	58524
All	Larson Davis CAL200 Calibrator	15314

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.1 dB in the field calibration was found to have occurred on all sound level meters.

4.3. Weather

The weather conditions during the survey were conducive to noise measurement it being dry, with low wind speeds. Weather conditions during the measurements were monitored by means of regular site visits.

The microphones were fitted with protective windshield for the measurements, which are described in Table 2, with an aerial photograph indicating its respective location shown in Figure 2.

³ British Standard 7445: 2003: Description and measurement of environmental noise. BSI

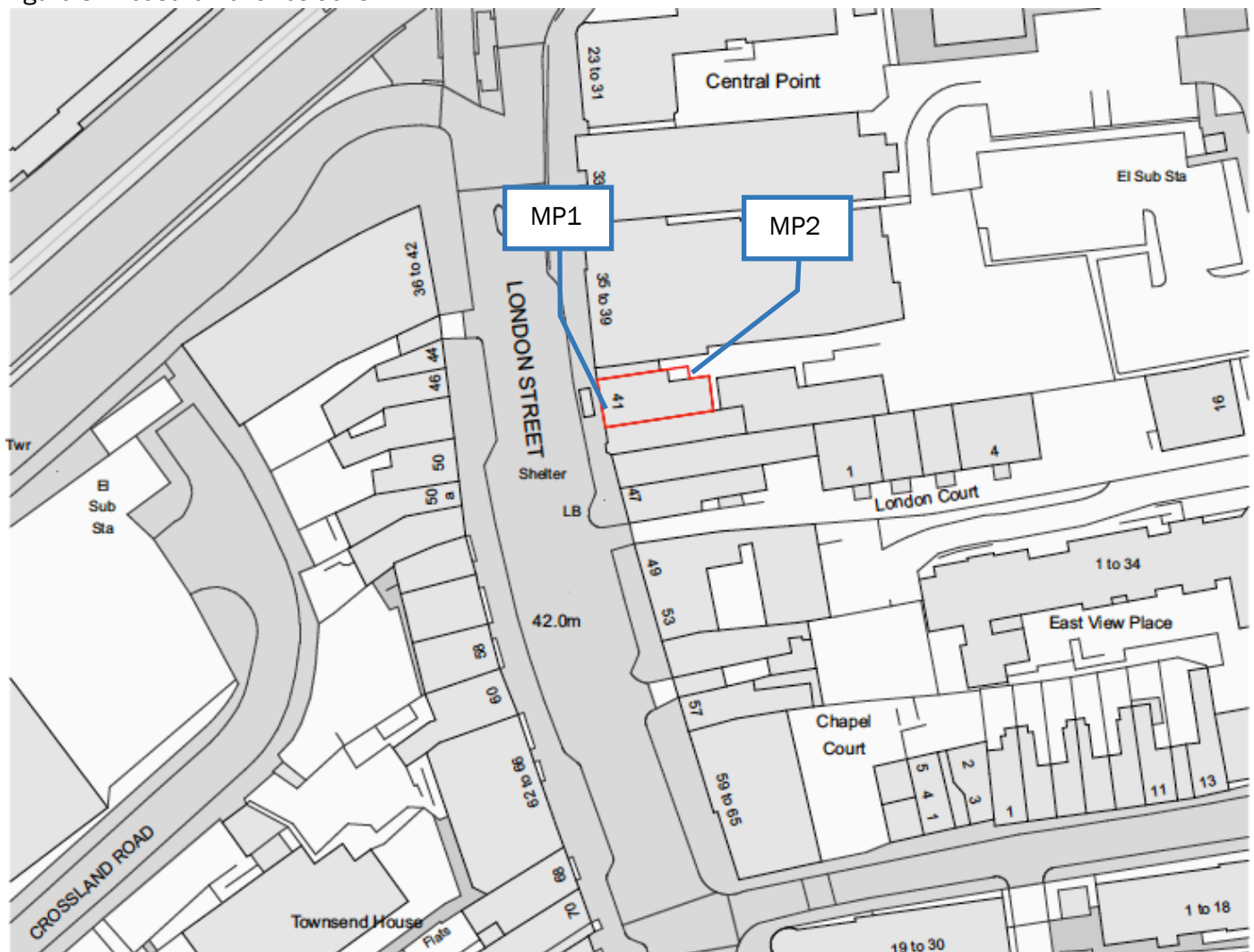
⁴ British Standard 61672: 2003: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

4.4. Measurement Locations

Table 3: Measurement Positions Descriptions

Measurement Position	Description
MP1	A largely unattended measurement of ambient sound at the façade along London Street. The measurement was undertaken under façade-field conditions, with the microphone located out the first-floor window. The sound environment was dominated by road traffic, general commercial activity and pedestrian noise from London Street.
MP2	A largely unattended measurement of ambient sound at the façade to the rear of the property. The measurement was undertaken under façade-field conditions, with the microphone located out the first-floor window. The sound environment consisted of distant road traffic, distant 'urban hum' from the nearby roads.

Figure 3: Measurement Positions



The summarised results of the environmental noise measurements are presented in The measurement results presented below include a façade field correction of 3dB.

Table 4, with the time history presented under Appendix B.

The measurement results presented below include a façade field correction of 3dB.

Table 4: Summary of Corrected Façade-Field Noise Measurement Results

Measurement Position	Period	Noise Level, dB			
		L _{Aeq,T}	Modal L _{A90}	L _{A10}	L _{Amax}
MP1	Day 07:00 – 23:00	67.7	54.9	70.0	85.1
	Night 23:00 – 07:00	59.6	41.2	60.4	76.5
MP3	Day 07:00 – 23:00	51.4	44.3	52.0	70.4
	Night 23:00 – 07:00	46.3	35.2	46.3	63.5

The spectral sound level measurements from the noise survey are outlined below.

Table 5: Corrected Façade Field Spectral Measurement Results

Period	dB(A)	Octave Band (Hz) Sound Level (dB)							
		63	125	250	500	1000	2000	4000	8000
MP1									
L _{eq,T}									
Day	67.7	71.3	62.9	61.2	60.5	62.5	61.4	58.5	58.4
Night	59.6	63.7	55.0	53.4	53.1	55.3	52.4	50.0	49.9
L _{FMax}									
Night	76.5	71.9	64.3	65.1	70.2	71.7	67.6	69.3	69.9
MP2									
L _{eq,T}									
Day	51.4	59.6	50.3	50.2	46.6	46.5	44.3	41.3	38.6
Night	46.3	54.3	43.3	41.6	39.2	41.8	41.8	31.8	26.2
L _{FMax}									
Night	63.5	71.5	60.5	58.8	56.4	59.0	59.0	49.0	43.4

5. NOISE ASSESSMENT

5.1. Façade Requirements

In order to achieve appropriate noise levels within internal living spaces, in those areas where such levels will not be achieved with open windows, the dwellings themselves need to be considered with regard to the level of façade mitigation required in order to achieve internal noise levels of $L_{Aeq,16\text{-hour}} < 35$ dB in habitable rooms during the day; $L_{Aeq,8\text{-hour}} < 30$ dB and typical L_{AFMax} levels of < 45 dB during the night.

The glazing and ventilation elements are typically the weakest acoustic link in the construction of a building facade. Therefore, in order to assess the acoustic performance of the proposed dwellings, it is appropriate in the first instance to explore the level of protection that will be afforded by the performance of the glazing and ventilation elements.

Windows do not reduce noise equally across the entire frequency spectrum, so the frequency content of the sound will influence the overall sound reduction performance of a given window and by extension, the resulting noise levels within the receiving room.

Many glazing manufacturers test their products under laboratory conditions using a typical road traffic noise frequency spectrum source. The resultant measured noise attenuation, in dB, gives a very useful guide to in-situ sound reduction performance of the window for situations where road traffic noise dominates. This performance index is known as the R_{TRA} , or $R_w + C_{tr}$.

Table 1 in Annex 6 of PPG 24, which is now superseded, but does contain some useful and relevant information, provides examples of typical noise reductions for a dwelling façade with windows set in a brick/block wall. The table shows various levels of noise reduction provided by different glazing configurations and for different noise sources. The values shown are the level difference (in dBA) between the outside and the inside of a typical dwelling and to represent worst case, it is assumed that the outside level is a façade measurement and that the relative contribution through any ventilation elements is negligible.

For a $R_w + C_{tr}$, PPG24 states that standard thermal double glazing will provide a façade sound insulation performance of 33 dB(A), which for free-field noise levels as predicted in this case would be 30 dB(A). As an example of a glazing unit that could achieve the above performance, the glazing manufacturer SG states that its 4/12/4 double glazed window unit has an $R_w + C_{tr}$ of 27 dB. This is considered to be a reliable performance expectation in the context of what would be installed on the quietest facades of the development. The 4/12/4 notation refers to a glazing unit comprising a 4 mm pane of glass and a 4 mm pane of glass, separated by a 12 mm air gap.

The Building Regulations recommend on ventilation that habitable rooms in dwellings have background ventilation. Internal noise levels should be considered in the context of room ventilation requirements. In this instance, the target internal noise levels will only be achieved in the majority of dwellings when windows are closed. An alternative means of ventilation will therefore be required to comply with the requirements of the Building Regulations Approved Document F.

In order to achieve the target daytime and night-time internal noise levels, it is necessary to determine the minimum acoustic performance requirements of each façade component. It is typically assumed that the default choice of glazing for the habitable rooms of the proposed development will be thermal double glazing and the default choice for ventilation will be a hit and miss, window-mounted trickle vent system.

As already stated; in order to provide a robust assessment and a high quality living environment for future residents, providing internal noise levels of < 35 dB $L_{Aeq,16\text{-hour}}$ by day and < 30 dB $L_{Aeq,8\text{-hour}}$ by night, as well as < 45 dB typical L_{AFMax} by night, as defined in BS 8233 has been adopted as the design target for the proposed development.

To determine the glazing and ventilation requirements in order to provide an adequate level of protection against external noise intrusion, $L_{Aeq,16\text{hour}}$ daytime, $L_{Aeq,8\text{hour}}$ and typical L_{AFMax} night-time noise levels have been determined at the building façade, making appropriate correction for the façade-field measurements.

Accordingly, the required composite $R_w + C_{tr}$ sound reduction performance for the building facades of the development, to provide appropriate internal noise levels during both daytime and night-time periods, as described, are identified in Table 6.

Table 6: Required Sound Level Difference Outside to Inside – Corrected Façade Levels

Index	Measured Free-field Noise Level, dB		Target Internal Noise Level - dB		Required Sound Level Difference, dB
	Day	Night	Day	Night	
London Street (Front Façade) - MP1					
L _{Aeq,T}	67.7	59.6	35	30	32.7
L _{AFMax}	-	76.5	-	45	31.5
Rear Façade - MP2					
L _{Aeq,T}	51.4	46.3	35	30	16.4
L _{AFMax}	-	63.5	-	45	18.5

Table 6 identifies that the sound reduction requirements for the development are driven by the adopted target daytime L_{Aeq} internal noise limit of 35 dB at the front of the building.

In regard to the rear of the building (MP2): BS8233 states, that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

As sound attenuates across a partially open window at a rate of 10 to 15 dB. On this basis, internal sound levels within rooms at the rear of the building; being located at the least noise-affected parts of the site, would achieve the requirements of BS8233:2014 with windows partially open for ventilation. Therefore, no mitigation would be required on this basis within this area of the site.

It should also be noted that the sound reduction detailed in Table 6 apply to habitable rooms such as living rooms, dining rooms and bedrooms only. For non-habitable rooms such as kitchens, bathrooms, stairways, halls, landings, lower performance standards would be permissible.

Based upon the latest layout proposals, room dimensions of the potentially worst affected rooms have been calculated to determine the likely required acoustic performances for the external façade elements, in order to provide appropriate internal noise levels in rooms during both the daytime and night-time periods.

The outline performance requirements are presented in Table 7.

Table 7: Minimum Acoustic Performances for Glazing and Ventilation

Example Glazing	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	R _w
	Sound Reduction Performance, R dB							
London Street - Front Facade								
Existing Glazing with 4 mm Secondary Glazing and a 100 mm Air Gap	22	26	34	44	56	53	52	46
Rear Facade								
Existing Glazing	-	-	-	-	-	-	-	-
Example Ventilation	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	D _{n,e,w}
	Element Normalised Level Difference (D,n,e) dB							
London Street – Front Facade								
Acoustic Trickle Ventilator	36	40	39	37	34	39	40	37
Rear Façade								
Partially opened windows are suitable to achieve the internal ambient noise criteria requirements of BS8233.								
Example Walls	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	R _w
	Sound Reduction Performance, R dB							
All Facades								
Façade Wall	36	41	45	45	54	58	58	52
Brick/ Blockwork Cavity Wall (BS8233)								

The above mitigation measures demonstrate that appropriate internal noise levels are entirely achievable through the use of suitable façade treatments, resulting in No Observed Adverse Effect.

Other units may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems. The above analysis is provided to demonstrate that a design solution is feasible at the site for the purposes of a planning application and not necessarily for the purposes of detailed design or glazing procurement.

The detailed design of the proposed properties may affect both the required sound reduction performance and the appropriate selection of glazing units. The aspects of the detailed design that are important are the room dimensions, room finishes, window dimensions and the sound reduction performance of non-glazing elements.

6. CONCLUSION

NRG Consulting has been commissioned to assess the impact of noise at 41 London Street, Reading, RG1 4PS in respect of the site's suitability for residential development.

The following technical noise assessment has been produced to provide supporting information to accompany a planning application to Reading Borough Council and is based upon environmental noise measurements undertaken at the site.

Specific consideration has been given to the internal noise criteria for proposed residential dwelling spaces, as quoted as within BS8233:2014, with façade mitigation measures proposed to achieve the criteria stipulated therein.

In light of the above, which demonstrates that the site is predicted to meet the requirements of the relevant British Standard and planning guidance, it is considered that noise does not present a constraint to granting of planning permission for the development.

7. APPENDICES

7.1. Appendix A – Definition of Terms

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of $20\mu\text{Pa}$ (20×10^{-6} Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table 8: Typical Sound Levels found in the Environment

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} .

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1\text{hour}}$ dB and $L_{A90,15\text{mins}}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

7.2. Appendix B – Measurement Results

Figure 4: Measured Time History – MP1

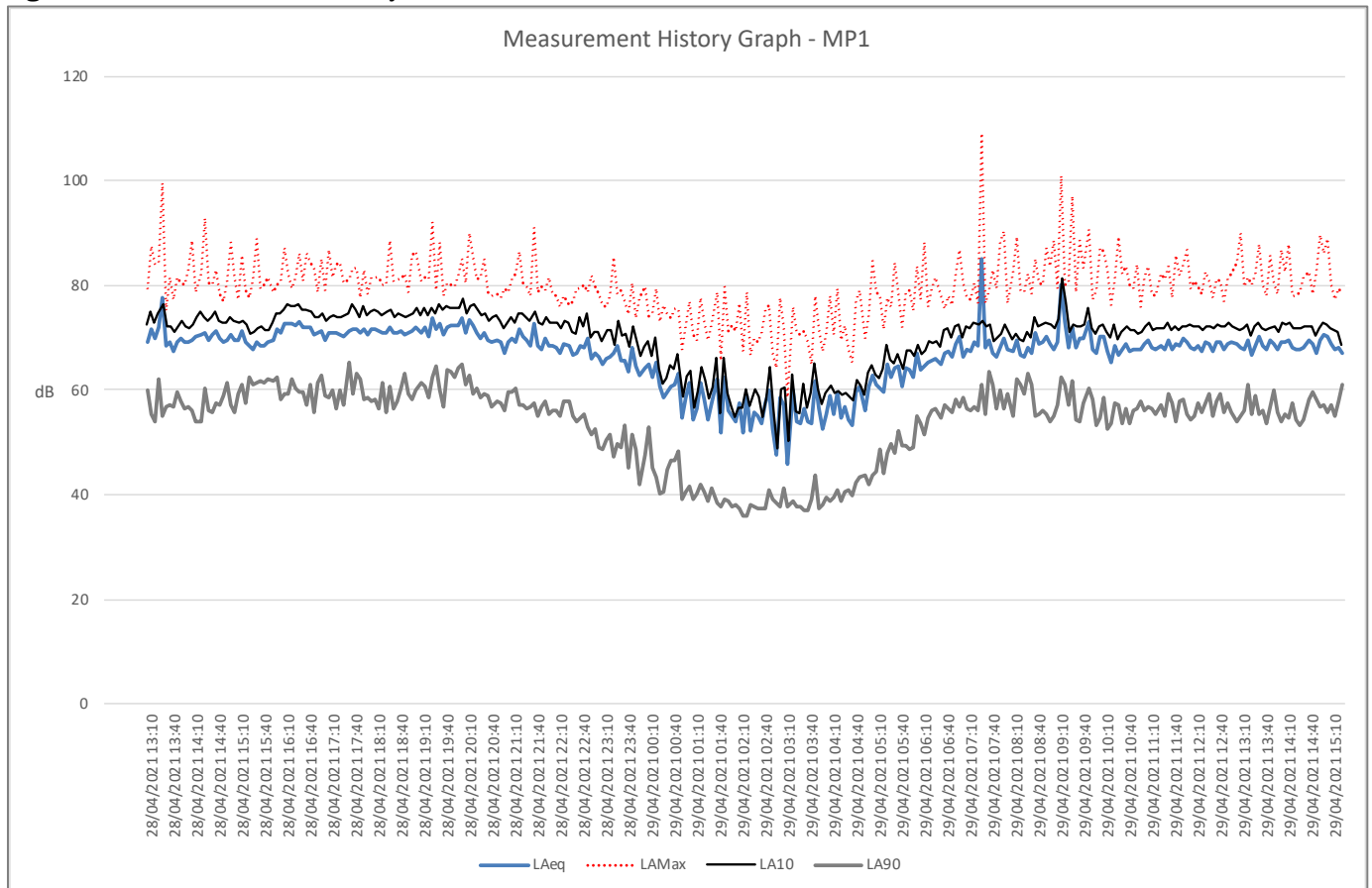


Figure 5: Measured Time History – MP2

