AF Acoustics Ltd
13 Bernard Ave
West Ealing
London
W13 9TG

Tel: +44 (0)20 3372 4430
Email: info@af-acoustics.com
www.af-acoustics.com

SAMMY MAK

102 - 104 KEW ROAD, RICHMOND, TW9 2PQ

NOISE IMPACT ASSESSMENT

30 OCTOBER 2019

1217-AF-00001-01

SAMMY MAK
102 - 104 KEW ROAD, RICHMOND, TW9 2PQ
NOISE IMPACT ASSESSMENT

DOCUMENT REFERENCE: 1217-AF-00001-01

REVIEW AND AUTHORISATION			
Authored and approved by Adrian Finn	**Position** Director	**Signature** 	**Date** 30/10/2019

AMENDMENT HISTORY			
Issue	**Status**	**Description**	**Date**
01	Draft	Report issued as draft	30/10/2019

CONTENTS **PAGE NO.**

APPENDIX E – LIMITATIONS TO THE REPORT

1. INTRODUCTION

1.1.1 Sammy Mak has commissioned AF Acoustics Ltd. to undertake a noise impact assessment for the redevelopment of 102-104 Kew Road, Richmond.

1.1.2 This report presents the results of the baseline noise survey, undertaken to establish the existing noise levels affecting the site. The survey results have been used to assess the suitability of the site for residential use and to set noise level targets for any proposed fixed plant.

1.1.3 Where necessary and feasible, mitigation measures have been identified with the aim of providing a suitable internal acoustic environment for future occupants.

2. SITE DESCRIPTION

2.1 Location

2.1.1 The site is located at 102-104 Kew Road, Richmond, and falls within the London Borough of Richmond. The site is shown in Figure 2.1 below. The site is in a mixed residential and commercial location. The site is bound directly on each side and on the opposite of Kew Bridge Road by commercial properties on the ground floor with residential properties above. There are residential preoperties to the rear of the development.

FIGURE 2.1: LOCATION MAP

2.1.2 It is proposed to part change of use of ground floor from A3 to C3 (Residential) and alterations to existing shopfront to create new access door to facilitate the conversion of existing 2 x 3 bed maisonettes into 7 No. self-contained Studio and 1 bed Flats.

3. GUIDANCE

3.1 Noise Policy Statement for England (NPSE)

3.1.1 The Noise Policy Statement for England (March 2010), sets out the long term vision of Government noise policy.

3.1.2 The vision of the NPSE is to 'Promote good health and a good quality of life through the effective management and control of noise within the context of Government policy on sustainable development.' This vision is supported by three key aims:

- avoid significant adverse impacts on health and quality of life;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

3.1.3 The NPSE should apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise but does not apply to noise in the workplace (occupational noise).

3.1.4 The NPSE had adopted the following concepts, to help consider whether noise is likely to have 'significant adverse' or 'adverse' effects on health and quality of life:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observed Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

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

3.1.5 However, the NPSE goes on to state that:

'*it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.*'

3.2 National Planning Policy Framework

3.2.1 The Ministry of Housing, Communities and Local Government revised the National Planning Policy Framework (NPPF) in July 2018. This framework updated the previous NPPF released in 2012 which previously replaced most national planning policy, circulars and guidance, including Planning Policy Guidance 24: Planning and Noise.

3.2.2 The NPPF defines the Government's planning policy for England and sets out the framework, within which local authorities must prepare their local and neighbourhood plans, reflecting the needs and priorities of their communities. Paragraph 170 of the NPPF requires Local Authorities to develop local policies and make decisions which aim to prevent new and existing development from contributing to, being put at unacceptable risk from, or being

adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.

3.2.3 Paragraph 180 of the NPPF requires that planning policies should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

> *'mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason'*

3.2.4 Paragraph 182 of NPPF introduces the "Agent of Change" principle and states that planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities and that existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

3.3 Professional Practice Guidance on Planning & Noise (ProPG)

3.3.1 Professional Practice Guidance on Planning & Noise (ProPG), 2017, was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system. The guidance document encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

3.3.2 The ProPG recommends a 2-stage approach, an initial noise risk assessment of the proposed development site and where the results indicate that noise requires further consideration a full assessment in the form of an Acoustic Design Statement (ADS).

3.3.3 The main emphasis of the ProPG is the encouragement of good acoustic design, such as site layout, building massing, orientation and internal layout, at an early stage of the development process. Good acoustic design will reduce the reliance on using the closed windows to ensure suitable internal noise levels and mitigate the impact of noise on external amenity areas such as gardens.

3.4 BS 8233:2014

3.4.1 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' contains a number of design criteria and guideline levels for the protection of new or planned development against external noise. The guidelines are designed to achieve desirable resting/ sleeping conditions in bedrooms and good listening conditions in other rooms. Those criteria which are most relevant to residential environment are reproduced in Table 3.1.

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

TABLE 3.1: DESIGN TARGETS FOR INDOOR AMBIENT NOISE LEVELS

3.4.2 It should also be noted that BS 8233:2014 states that "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." However, no numerical values for internal $L_{Amax,F}$ levels in dwellings are stated within BS 8233.

3.4.3 With regards to external amenity areas, BS 8233 recommends that "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." The Standard also states that these guideline values are not always achievable in all circumstances and therefore a compromise between elevated noise levels and 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.

3.4.4 In addition, BS 8233 states that "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."

3.5 World Health Organisation Noise Guidelines

3.5.1 The guidelines presented in the World Health Organization (WHO) document reflect conclusions drawn up after consideration of international research evidence on the health effects of exposure to noise. The guidelines define the goal of noise management as 'to maintain low noise exposures such that human health and well-being are protected', with 'specific objectives to develop criteria for the maximum safe exposure levels and to promote noise assessment and control as part of environmental health programmes'.

3.5.2 These WHO guideline values are based on precautionary limits for community noise in specific environments and are reproduced below.

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB L_{AFMAX}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB L_{AFMAX}
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

TABLE 3.2: WHO COMMUNITY NOISE GUIDELINE VALUES

3.5.3 It should be noted that the above values generally apply to 'anonymous' or everyday levels of environmental noise from road traffic, trains and aircraft. Human reaction to tonal and low frequency noise may be underestimated by the dB(A) noise level and hence lower limits may apply.

3.6 British Standard 4142:2014

3.6.1 BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' describes methods for rating and assessing sound from "fixed installations which comprise mechanical and electrical plant and equipment", amongst other sources of noise.

3.6.2 The methodology contained within BS 4142:2014 uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

3.6.3 A summary of the approach set out within BS 4142:2014 is set out below:

- establish the specific sound level of the source(s);
- measure the representative background sound level, typically by measurement close to the receptor location;
- rate the specific sound level to account for any distinguishing characteristics;
- estimate the impact by subtracting the background sound level from the rating level; and
- consider the initial estimate of impact, in the context of the noise and its environment.

3.6.4 An initial estimate of the impact of the specific sound is obtained by subtracting the background sound level from the rating level. Using this approach, BS 4142 states:

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

3.6.5 Certain acoustic features can increase the significance of the impact over that expected from a basic comparison between specific sound level and the background sound level. These features include tonality and impulsivity, as well as additional characteristics and intermittency of the sound.

3.6.6 If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor.

3.6.7 The specific sound level is rated to account for distinguishing characteristics by using the penalties below:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

3.6.8 Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor.

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

3.6.9 For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

3.6.10 If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

3.6.11 If a subjective assessment is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

- 15 dB in the low frequency one-third octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency one-third octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency one-third octave bands (500 Hz to 10000 Hz)

3.6.12 If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

3.7 London Borough of Richmond upon Thames

3.7.1 The Supplementary Planning Document (SPD), 'Noise Generating and Noise Sensitive Development' gives the following guidance about noise from new noise generating industrial and commercial developments, and for noise sensitive developments.

3.7.2 The SPD states that BS4142:2014 should be followed in calculating the rating and assessing sound from plant.

3.7.3 The SPD states that Richmond upon Thames will seek to achieve the external noise standards detailed in Table 3.3 below

Noise Impact From Relevant Proposed Industrial Or Commercial Premises Or Plant	Development Outcome
Rating Level ($L_{Ar,Tr}$) is at least 5 dB(A) below the Background Level L_{A90}	Normally acceptable
Rating level ($L_{Ar,Tr}$) is no more than 5 dB(A) above the Background Level L_{A90}	Acceptable only if there are overriding economic or social reasons for development to proceed
Rating level ($L_{Ar,Tr}$) is more than 5 dB(A) above the Background Level L_{A90}	Normally unacceptable

TABLE 3.3: NEW INDUSTRIAL AND COMMERCIAL DEVELOPMENT - EXTERNAL NOISE STANDARDS

3.7.4 The SPD states that the borough will normally seek to achieve the design noise levels contained in Table 4 of BS8233:2014 in all noise sensitive rooms. This is reproduced below.

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

TABLE 3.4: CROYDON'S DESIGN TARGETS FOR INDOOR AMBIENT NOISE LEVELS
Note - In bedrooms at night, individual noise events should not normally exceed 45 dB L_{AMAX}.

3.8 Planning Conditions

3.8.1 The following planning conditions relating to noise for 102 - 104 Kew Road, Richmond, reference DC/VAA/19/2300/FUL/FUL has been placed on the development.

- U0069426 Noise Transmission from Commercial Use

  A scheme for the sound insulation of separating partitions, including walls and ceilings, between the restaurant unit and any structurally adjoining residential units shall be submitted to and approved in writing by the local planning authority. The scheme approved by the local planning authority shall be fully implemented in accordance with the approved details before the use, hereby permitted, commences. No alteration to the ceiling which undermines the sound insulation integrity of the partition shall be undertaken without the grant of further specific consent of the local planning authority. The sound insulation scheme will need to ensure a sound insulation performance of at least that detailed in the table below.

  Sound Insulation Guideline Levels
  Purpose Built Mixed Use Development Walls /Floors/Ceilings
  Airborne Sound Insulation Performance DnT,w + Ctr dB 48 to 53 (dependant on significance)
  REASON: To safeguard the amenity of prospective residents.

- U0069427 Kitchen Extraction System

a) prior to first occupation a scheme for the relocation of the kitchen extraction system shall be submitted to and approved in writing by the local planning authority which demonstrates that the following noise design requirements can be complied with and shall thereafter be retained as approved
b) The measured or calculated rating level of noise emitted from the kitchen extraction plant to which the application refers, shall be no greater than the existing background noise level, at all times that the mechanical system etc. operates. The measured or calculated noise levels shall be determined at the boundary of the nearest ground floor noise sensitive premises or 1 meter form the facade of the nearest first floor (or higher) noise sensitive premises, and in accordance to the latest British Standard 4142; An alternative position for assessment /measurement may be used to allow ease of access, this must be shown on a map and noise propagation calculations detailed to show how the design criteria is achieved.
c) The kitchen extraction plant shall be on adequately mounted on anti-vibration supports to prevent the structural transmission of vibration and regenerated noise within adjacent or adjoining premises, details of which shall be submitted to and approved in writing by the local planning authority and shall be so maintained thereafter.
d) A commissioning acoustic test and report shall be undertaken, in order to demonstrate that condition 1(b)above has been achieved. The results of the test shall be submitted to and approved in writing by the LPA.
REASON: To safeguard the amenity of the surrounding area.

- U0069428 Noise Protection Scheme

  The residential units to which the application refers shall be constructed so as to provide sound attenuation against externally generated noise sources so as to achieve the internal ambient noise levels detailed below. The measured or calculated noise levels shall be determined in accordance to the latest British Standard 8233:2014
  Guidance on sound insulation and noise reduction for buildings. Any works which form part of the scheme shall be completed in accordance with the approved details before the dwellings are occupied and shall thereafter be retained as approved.
  Internal noise levels should be achieved with windows open for rapid ventilation purposes. Where this cannot be achieved alternative means of ventilation and cooling will be required. Where whole house ventilation is provided then acoustically treated inlets and outlets should ideally be located away from the façade(s) most exposed to noise (and any local sources of air pollution).

  Internal Ambient Noise Levels for Dwellings

Situation	*Location*	*07:00 - 23:00 hrs.*	*23:00 - 07:00 hrs.*
Resting	*Living room*	*35 dB LAeq,16 hour*	*-*
Dining	*Dining room/area*	*40 dB LAeq, 16 hour*	*-*
Sleeping (daytime resting)		*Bedroom 35 dB LAeq,16 hour*	

23:00 - 07:00 hrs.			
30 dB LAeq, 8 hour			
Sleeping	*Bedroom*	*-*	*45 dB LAMax (several times in any one hour)*

  REASON: To safeguard the amenity of prospective residents.

4. NOISE SURVEY AND MEASUREMENTS

4.1 Unattended Noise Survey

4.1.1 An unattended noise survey was undertaken by Adrian Finn of AF Acoustics at the front and rear of 102 - 104 Kew Road, Richmond.

4.1.2 The duration of the survey at the rear of the property was between 16:15 on 10 October and 16:30 on 11 October 2019. The measurement location was located on the flat roof at the rear of the property. This measurement location is labelled as LT1 in Figure 4.1. The measured noise levels are considered free-field levels.

4.1.3 The duration of the survey at the front of the property was between 12:00 on 21 October and 12:30 on 22 October 2019. The measurement location was located on the 2nd floor balcony overlooking Kew Bridge Road. This measurement location is labelled as LT2 in Figure 4.1. The measured noise levels are considered façade levels.

4.1.4 Both sets of measurements were carried out in accordance with the requirements of BS 7445-2:1991 and ISO 1996-2:1987.

4.1.5 Initial inspection of the site and the noise monitoring revealed that the noise profile at the LT1 monitoring location was dominated by plant noise from neighbouring commercial properties. The noise profile at the LT2 monitoring location was dominated by road traffic noise from Kew Bridge Road. Planes flying overhead also added to the noise environment at both locations.

4.1.6 The same sound level meter was used for both sets of measurements and had calibration checks before and after the measurement surveys to generate a calibration level of 114 dB at 1 kHz. The equipment calibration was verified before and after the survey and no calibration drift was observed. The microphone was fitted with a windshield.

4.1.7 The equipment used is shown in Table 4.1.

Name	Serial Number	Last Calibrated
Norsonic 118 Class 1 Sound Level Meter	31382	February 2018
Norsonic 1206 Pre-amplifier	30416	February 2018
Gras 40AF Microphone	150690	February 2018
Norsonic 1251 Sound Calibrator	30900	March 2019

TABLE 4.1: NOISE MEASUREMENT EQUIPMENT

4.2 Location

4.2.1 The monitoring location is shown below in Figure 4.1.

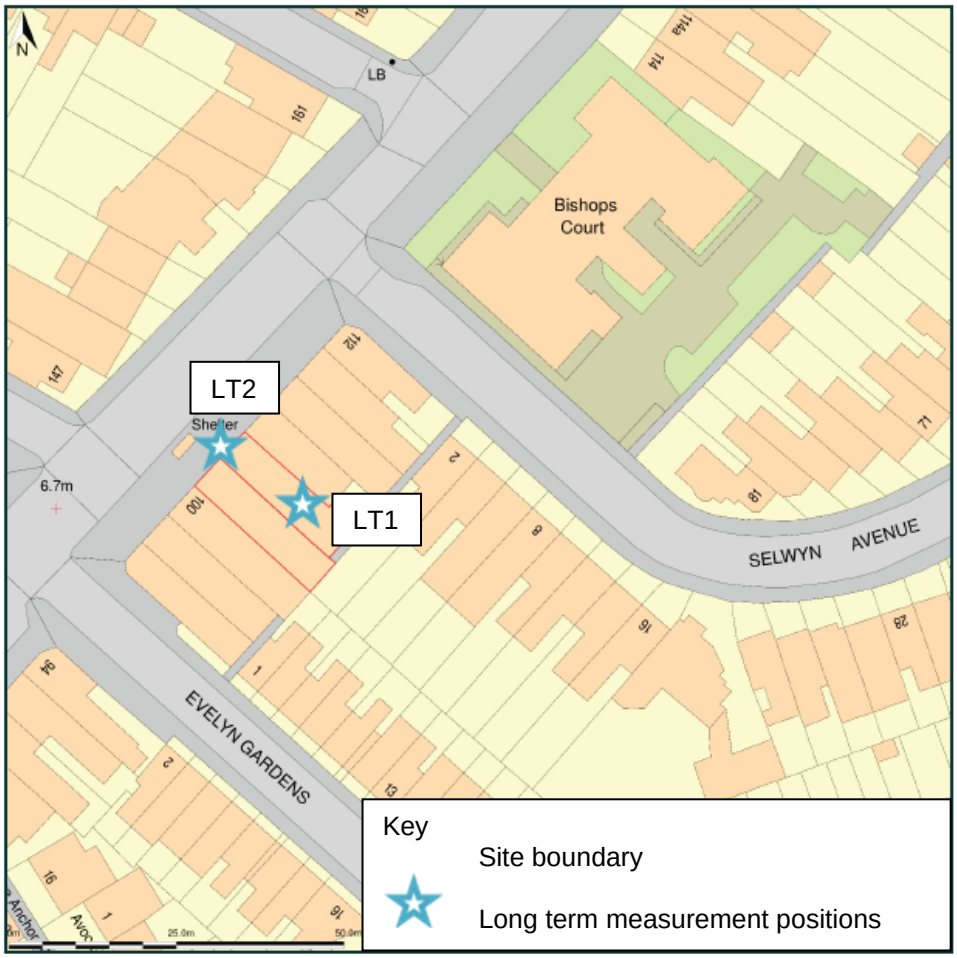


FIGURE 4.1 : NOISE MONITORING LOCATION

4.3 Measurement Weather Conditions

4.3.1 Weather data was taken during the unattended measurement period. The weather equipment consisted of a Davis Vantage Vue weather meter and data logger which measures and records air temperature, relative humidity, precipitation intensity, precipitation type, precipitation quantity, air pressure, wind direction and wind speed.

4.3.2 The weather during the unattended noise survey was dry and sunny during the daytime, average wind speeds remained below 3 ms^{-1}.

4.4 Results – Unattended – LT1

4.4.1 A summary of the time-averaged ambient noise levels and background noise level, along with typical maximum noise level are presented in Table 4.2 below. The L_{A90} background noise level has been derived considering the most commonly occurring 1 hour period during the day and 15 minute period at night, whilst the $L_{Amax,F}$ maximum noise level is the 90th percentile of the measured maximum noise levels. The results of the continuous noise monitoring survey are presented in graphical form in Figure A3 of Appendix A.

Time period	Measured Noise Levels (dB re 2.0 x 10^{-5} Pa)		
	$L_{Amax,S}$	$L_{Aeq,T}$	Typical $L_{A90,T}$
Day (07:00 – 23:00)	85	65	58
Night time (23:00 – 07:00)	83	61	46

TABLE 4.2: SUMMARY OF UNATTENDED NOISE MEASUREMENTS

4.5 Results – Unattended – LT2

4.5.1 A summary of the time-averaged ambient noise levels and background noise level, along with typical maximum noise level are presented in Table 4.2 below. The L_{A90} background noise level has been derived considering the most commonly occurring 1 hour period during the day and 15 minute period at night, whilst the $L_{Amax,F}$ maximum noise level is the 90th percentile of the measured maximum noise levels. The results of the continuous noise monitoring survey are presented in graphical form in Figure A3 of Appendix A.

Time period	Measured Noise Levels (dB re 2.0 x 10^{-5} Pa)		
	$L_{Amax,S}$	$L_{Aeq,T}$	Typical $L_{A90,T}$
Day[1] (07:00 – 23:00)	82	64	55
Night time[1] (23:00 – 07:00)	90	64	55

TABLE 4.3: SUMMARY OF UNATTENDED NOISE MEASUREMENTS

Note 1) 3dB has been deducted from the measured data to account for façade reflections

5. SITE SUITABILITY ASSESSMENT

5.1 External Noise Levels

5.1.1 This section provides an assessment of the suitability of the site for residential use with respect to noise.

5.1.2 A summary of the measured daytime and night-time noise levels is presented in section 4.4.

5.2 External Building Fabric Design

5.2.1 The glazing assessment has been based on the measured daytime and night-time noise levels and are based on the proposed layout, shown in Figure A1 of Appendix A.

5.2.2 When assessing the sound insulation performance of an external building fabric system, it is generally regarded that the glazing element is the weakest path for external noise intrusion into internal areas. It is assumed that the non-glazed areas of any façade systems may incorporate sufficient acoustic treatment behind such that the glazing remains the weakest path for external noise intrusion. As such, the acoustic performance of the glazing will be the most critical element in determining the overall sound insulation performance of the external façade.

5.2.3 Table 5.1 presents the sound insulation performance specifications recommended for the external building fabric system along with typical constructions capable of achieving the internal ambient noise criteria set out in BS8233:2014 and to meet planning condition U0069428.

Façade Element	Living Room Facing Kew Bridge Road	
	Sound Insulation Performance, dB $R_W + C_{tr}$	Example Constructions
External wall Fabric	45	Brick block cavity wall or similar
Glazing	25	4mm glass / 6mm air gap / 4mm glass
These values have been based on: Ventilation – Ventilation – acoustic trickle vents with a sound insulation of 37 dB $D_{n,e,w}$ Rooms - 112m^3 room volume with 18.2m^2 external façade and a 6.6m^2 window. Calculations were carried out using reverberation time (RT60) of 0.5 seconds across all frequency bands.		

TABLE 5.1: SOUND INSULATION PERFORMANCE AND INDICATIVE CONSTRUCTIONS FOR THE LIVING ROOMS FACING KEW BRIDGE ROAD

Note: The acoustic specification for the windows are given in Appendix C.
The acoustic specification for the ventilators are given in Appendix D.

Façade Element	Living Room Facing Rear Of The Property	
	Sound Insulation Performance, dB $R_W + C_{tr}$	Example Constructions
External wall Fabric	45	Brick block cavity wall or similar
Glazing	30	10mm glass / 6mm air gap / 4mm glass
These values have been based on: Ventilation – Ventilation – acoustic trickle vents with a sound insulation of 37 dB $D_{n,e,w}$ Rooms - 53m^3 room volume with 23m^2 external façade and a 4.5m^2 window. Calculations were carried out using reverberation time (RT60) of 0.5 seconds across all frequency bands.		

TABLE 5.2: SOUND INSULATION PERFORMANCE AND INDICATIVE CONSTRUCTIONS FOR THE LIVING ROOMS FACING THE REAR OF THE PROPERTY

Note: The acoustic specification for the windows are given in Appendix C.
The acoustic specification for the ventilators are given in Appendix D.

Façade Element	Bedrooms Facing Rear of The Property	
	Sound Insulation Performance, dB $R_W + C_{tr}$	Example Constructions
External wall Fabric	45	Brick block cavity wall or similar
Glazing	30	10mm glass / 6mm air gap / 4mm glass
These values have been based on: Ventilation – acoustic trickle vents with a sound insulation of 40 dB $D_{n,e,w}$ Rooms - 53m^3 room volume with 22.1m^2 external façade and a 3m^2 window. Calculations were carried out using reverberation time (RT60) of 0.5 seconds across all frequency bands.		

TABLE 5.3: SOUND INSULATION PERFORMANCE AND INDICATIVE CONSTRUCTIONS FOR THE BEDROOMS FACING THE REAR OF THE PROPERTY

Note: The acoustic specification for the windows are given in Appendix C.
The acoustic specification for the ventilators are given in Appendix D.

5.2.4 The calculation sheets are shown in Table B1 Table B3 of Appendix B.

5.2.5 Typical glazing configurations are quoted for guidance only and alternatives may be utilised, in any case, acoustic performance of the system proposed must be demonstrated to the satisfaction of the acoustic consultant. The sound reduction performance quoted above must be achieved by the glazing system taken as a whole in its installed condition. The specification, therefore, applies to the glazing, the frames and all seals on any openable parts of the systems and any required ventilation or condensation control mechanisms. This list is not exhaustive: no part of the glazing system shall cause the above figures not to be achieved.

6. PLANT NOISE EMISSION EGRESS

6.1.1 The proposed development is likely to include external fixed plant items located at the rear of the property, to replace the current plant used in the restaurant. At this stage of the design stage process it is unknown what the plant will be. However to aid the plant selection process the plant noise emission target is set out below.

6.1.2 Free-field noise levels have been derived from the typical background noise levels, as presented in Table 4.2. The typical background noise levels as measured at LT1, are 58 dB $L_{A90,1hour}$ during the daytime (07:00 – 23:00), 46 dB $L_{A90,15min}$ during the night (23:00 – 07:00).

6.1.3 In line with the guidance within BS 4142:2014 and planning condition U0069427 that the measured or calculated rating level of noise emitted from the kitchen extraction plant to which the application refers, shall be no greater than the existing background noise level as measured from any point 1 metre outside the window of any room of a neighbouring residential property.

6.1.4 Consequently, it is proposed that the free-field design target for any proposed plant should be 58 dB $L_{Ar,Tr}$ during the daytime (07:00 – 23:00) and 46 dB $L_{Ar,Tr}$ during the night (23:00 – 07:00) at 1m from the façade of the nearest dwellings

6.1.5 It will be necessary to design, select, locate and/or attenuate collectively all building services plant on the site such that the design noise level criteria, set above, are achieved. The target criteria apply to all plant, and so individual plant items may need to be designed to achieve a lower level such that the overall noise emission limits are achieved.

7. SOUND INSULATION

7.1 Separating Floors/Ceilings

7.1.1 Planning condition U0069426 states that the sound insulation of separating partitions, including walls and ceilings, between the restaurant unit and any structurally adjoining residential units should achieve 48 to 53 dB $D_{nT,w} + C_{tr}$.

7.1.2 Airborne sound insulation tests were undertaken between the restaurant and two of the bedrooms above and achieved 47 and 48 dB $D_{nT,w} + C_{tr}$. The graphs are presented in Figure A4 and Figure A5 of Appendix A

7.1.3 In order to satisfy the requirements for airborne between the restaurant and flats above, the following is recommended:

- utilise a proprietary floating floor system such as Trim Acoustics Defender 32 or Isomass Isocheck 24T or similar laid over existing flooring. It is important to follow the manufacturers instruction with regards to installation to avoid any flanking paths being created.
- The floor cavity should be partially filled (a good rule of thumb is 50% - 75%) with mineral wool insulation (minimum density 45 kg/m^3).

7.1.4 The floating floor should be separated from the external wall lining by carrying the resilient layer up at all room edges to isolate the floating floor from the wall surface. If the choice of floor system does not permit this then a flanking strip should be inserted vertically between the floating floor and external wall lining.

7.1.5 It is possible to meet the requirements set out by Richmond Council using alternative floor build-ups. The above build-up is a typical example that will meet the requirements of planning condition U0069426. As the proposed development is still at early design stage, the floor make-ups have not been finalised. It is expected that an acoustic consultant will be consulted to ensure acoustic compliance.

8. CONCLUSION

8.1.1 Sammy Mak commissioned AF Acoustics Ltd. to undertake a noise impact assessment for the redevelopment of 102-104 Kew Road, Richmond.

8.1.2 The primary aim of the assessment has been to establish the suitability of the site for residential use, in terms of achieving an adequate internal and external acoustic environment for future occupants.

8.1.3 A baseline noise survey was undertaken in October 2019. From this survey, and in accordance with the relevant criteria, the daytime and night-time ambient and background noise levels have been determined, as well as the maximum noise levels at night.

8.1.4 Based on the measured noise levels and the internal noise criteria adopted in accordance with the relevant standards, an assessment of the acoustic performance of the glazed elements of the external building fabric has been undertaken. The ventilation strategy has also been outlined.

8.1.5 Design noise level targets for any fixed building services plant associated with the proposed development have been presented, which should be used as the detailed design progresses in order that the plant is selected and installed appropriately.

8.1.6 The report shows the required improvement in the floor build up between the restaurant and the flats above to meet planning condition U0069426.

8.1.7 The limitations to this report are presented in Appendix E.

AF Acoustics

APPENDIX A: FIGURES

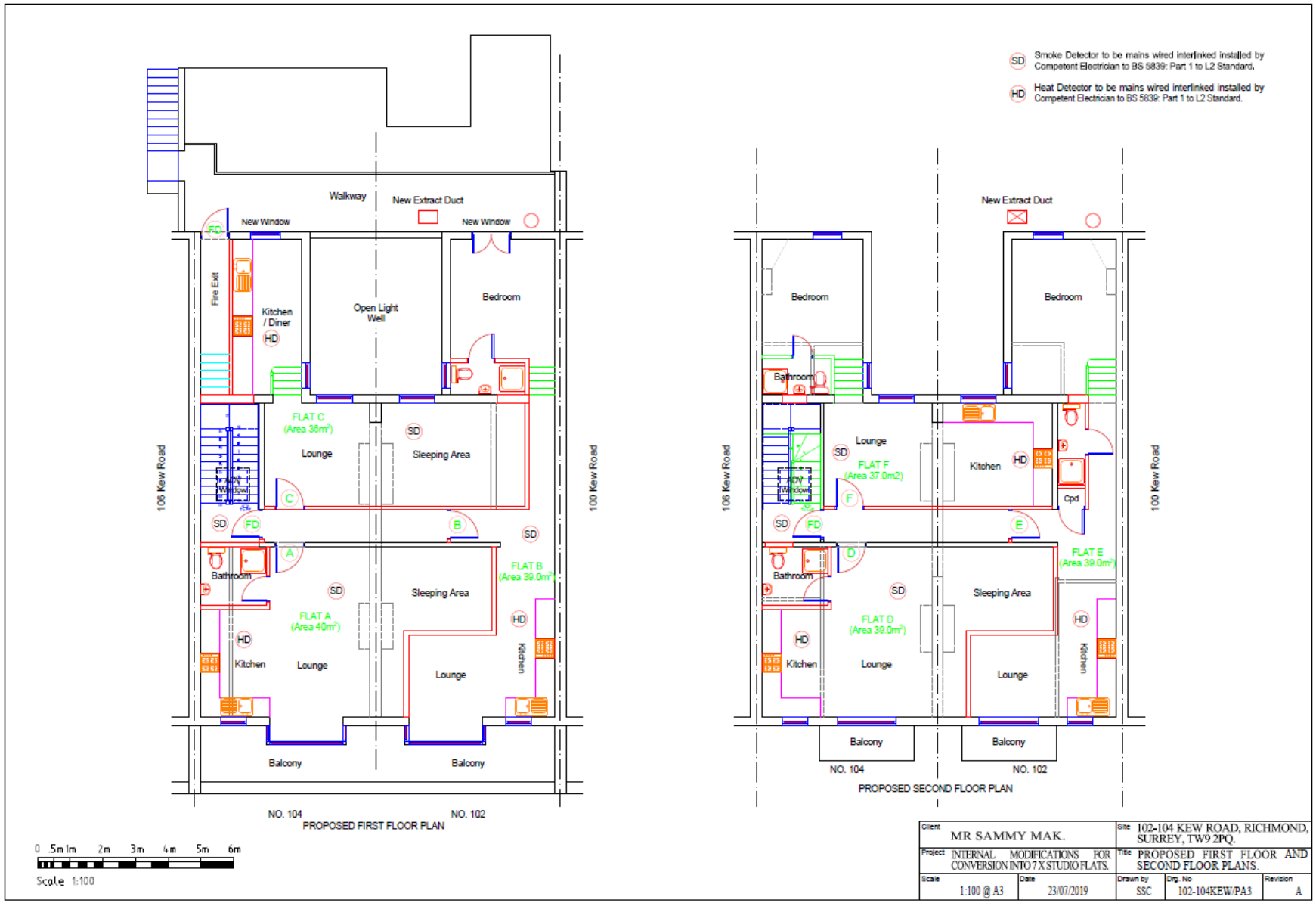


FIGURE A1: GROUND FLOOR LAYOUT

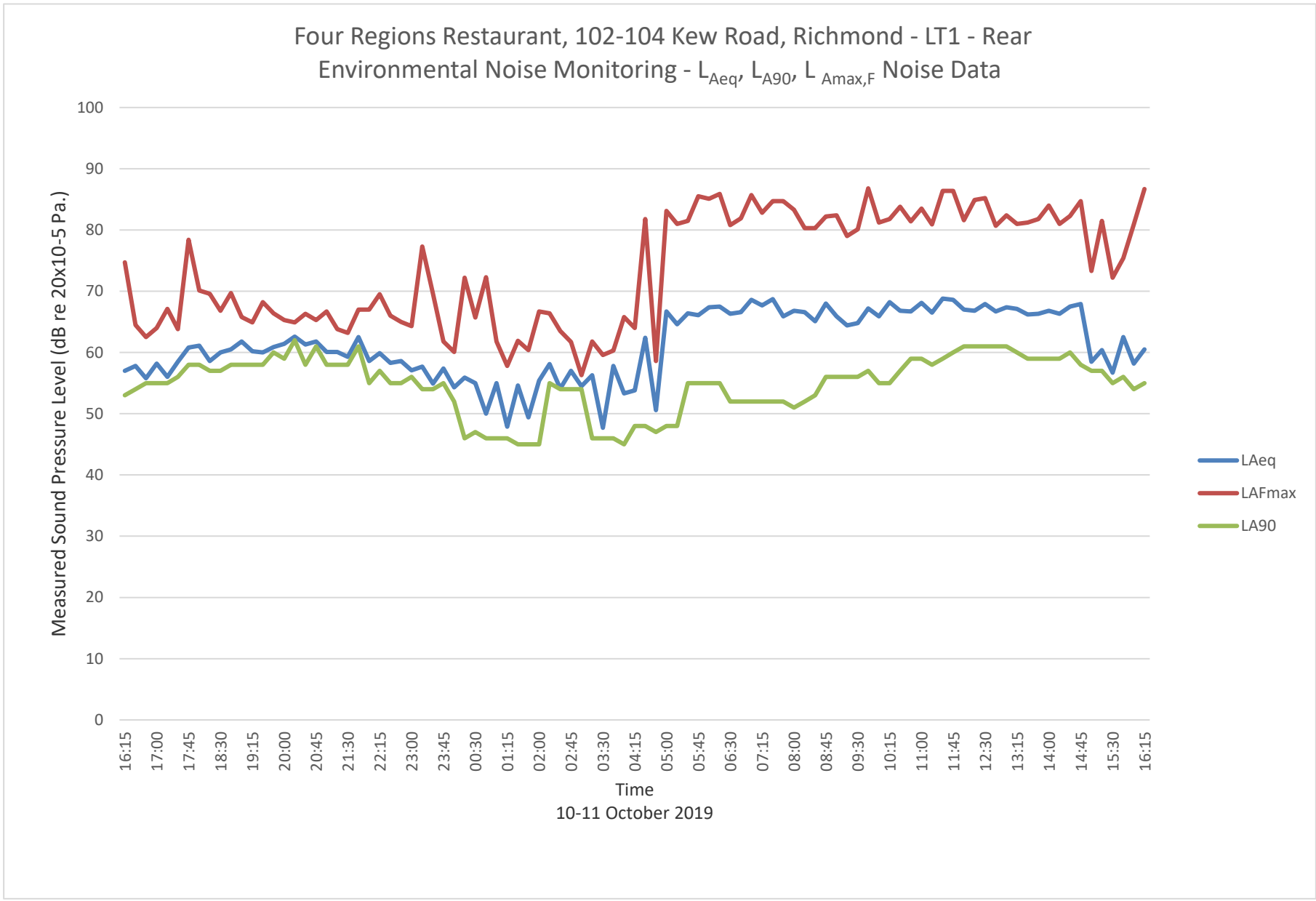


FIGURE A2: NOISE MEASUREMENT RESULTS LT1

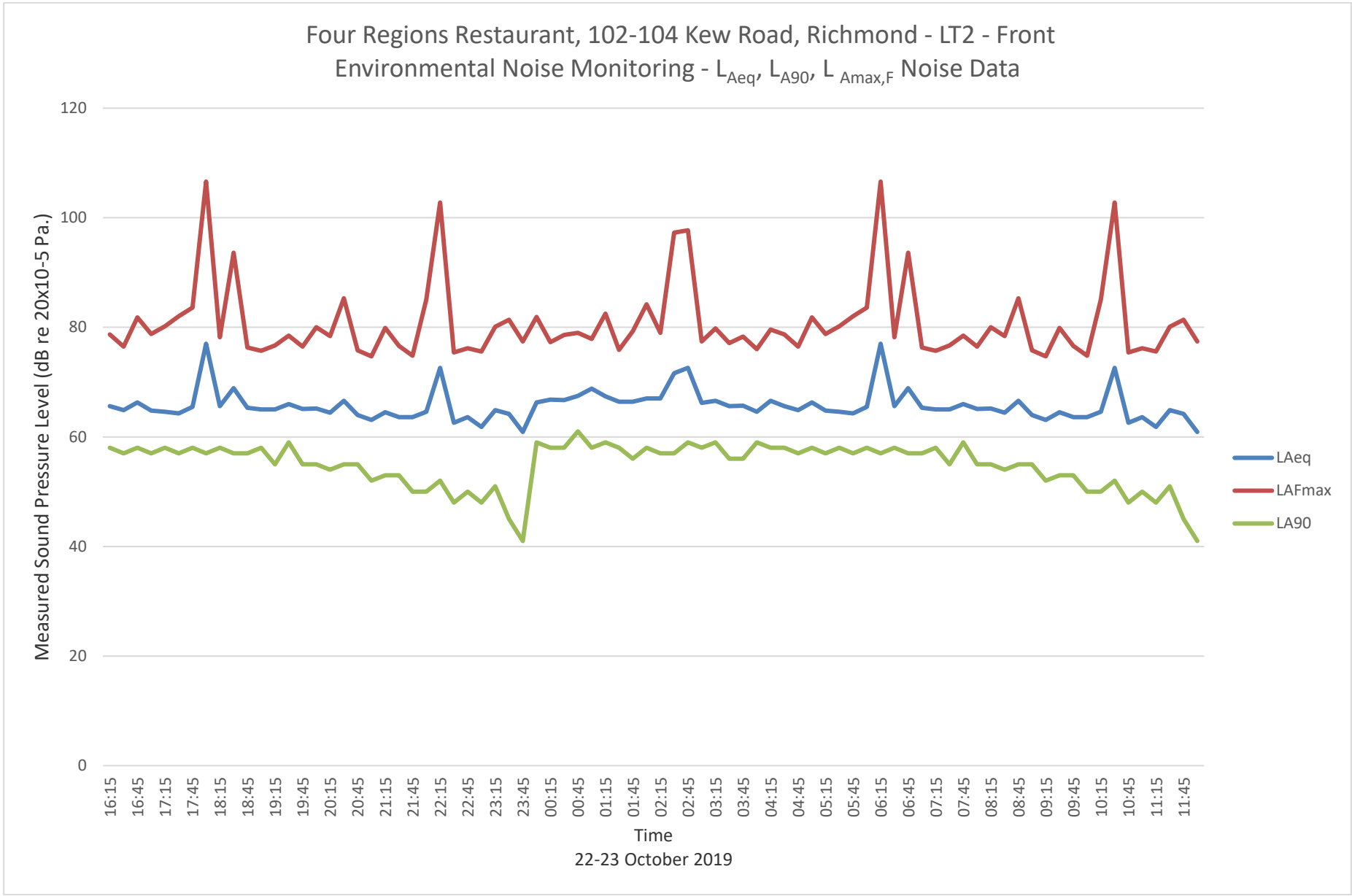


FIGURE A3: NOISE MEASUREMENT RESULTS LT2

Standardized level difference according to ISO 140-4
Field measurements of airborne sound insulation between rooms

Client: Mr Sammy Mak Date of test: 10/10/2019

Description and identification of the building construction and the test arrangement, direction of measurement:

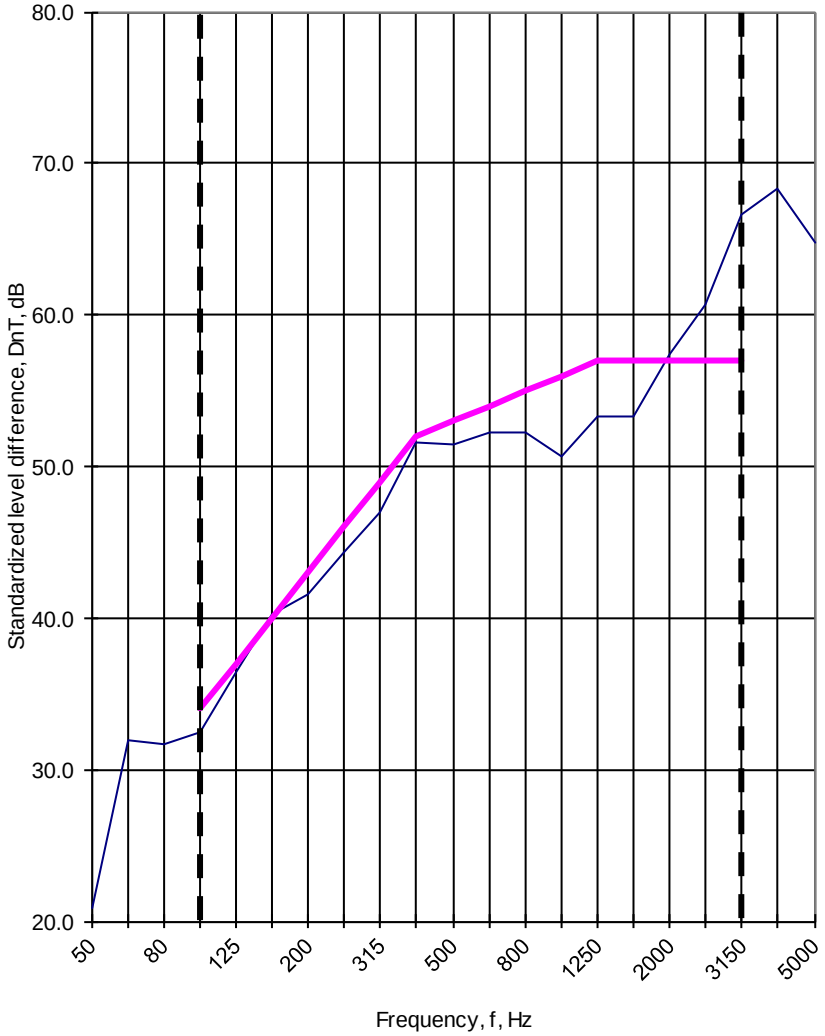
Airborne floor, Restaurant to Bedroom 1
Construction details: Unknown

Source room volume: 647 m³
Receiving room volume: 54 m³

— — — Frequency range according to the
——— curve of reference values (ISO 717-1)

Frequency f Hz	D_{nT} (one-third octave) dB
50	20.9
63	31.9
80	31.7
100	32.5
125	36.4
160	40.3
200	41.5
250	44.4
315	47.0
400	51.6
500	51.4
630	52.3
800	52.3
1000	50.7
1250	53.2
1600	53.3
2000	57.3
2500	60.6
3150	66.6
4000	68.3
5000	64.7

* Signifies value at limit of measurement



Rating according to ISO 717-1

$D_{nT,w}$ (C;Ctr) = 53 (-1 ; -6) dB $C_{50-3150}$ -2 dB $C_{50-5000}$ -1 dB $C_{100-5000}$ -1 dB
$D_{nT,w}$ + Ctr = 47 dB
Evaluation based on field measurement results obtained by an engineering method $C_{tr,50-3150}$ -10 dB $C_{tr,50-5000}$ -10 dB $C_{tr,100-5000}$ -6 dB

Name of test company : AF Acoustics
Signature:

FIGURE A4: SOUND INSULATION TEST BETWEEN THE RESTAURANT AND BEDROOM 1

Standardized level difference according to ISO 140-4
Field measurements of airborne sound insulation between rooms

Client: Mr Sammy Mak Date of test: 10/10/2019

Description and identification of the building construction and the test arrangement, direction of measurement:

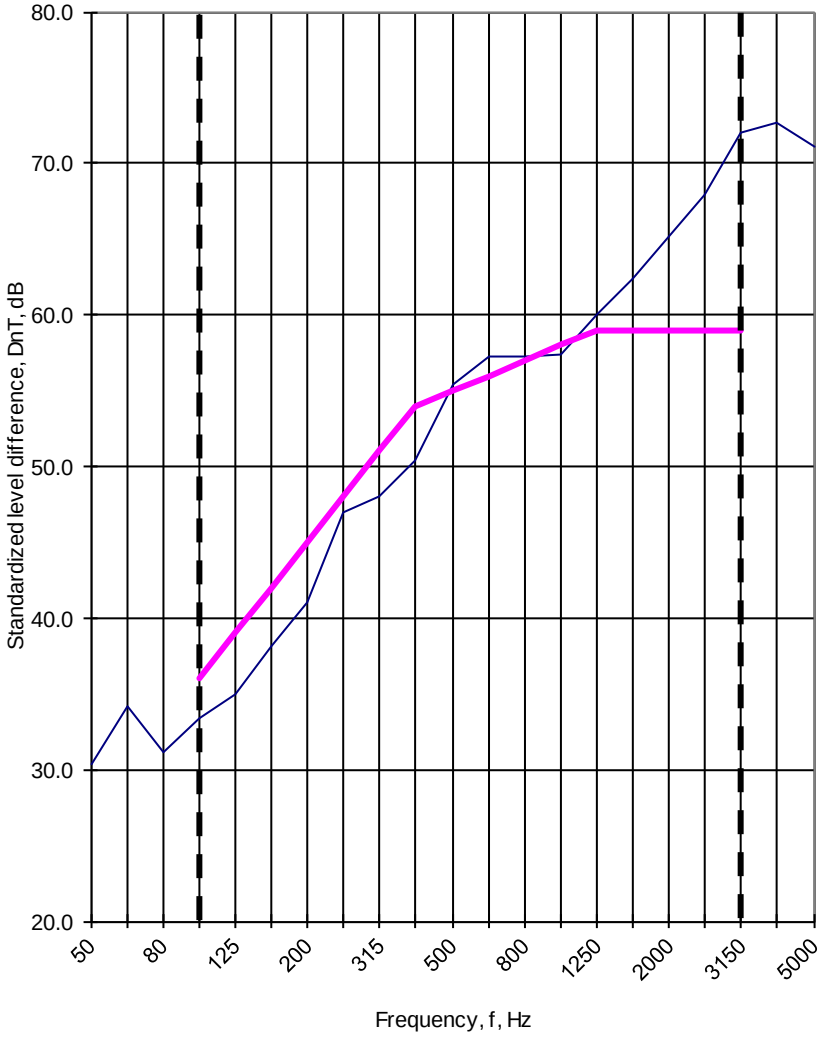
Airborne floor, Restaurant to Bedroom 2
Construction details: Unknown

Source room volume: 647 m³
Receiving room volume: 39 m³

Frequency range according to the curve of reference values (ISO 717-1)

Frequency f Hz	D_{nT} (one-third octave) dB
50	30.4
63	34.1
80	31.1
100	33.4
125	34.9
160	38.1
200	41.1
250	46.9
315	48.0
400	50.4
500	55.4
630	57.3
800	57.3
1000	57.4
1250	60.1
1600	62.4
2000	65.2
2500	67.9
3150	72.1
4000	72.7
5000	71.1

* Signifies value at limit of measurement



Rating according to ISO 717-1

$D_{nT,w}$ (C;Ctr) = 55 (-2 ; -7) dB
$D_{nT,w}$ + Ctr = 48 dB
Evaluation based on field measurement results obtained by an engineering method

$C_{50\text{-}3150}$	-2 dB	$C_{50\text{-}5000}$	-1 dB	$C_{100\text{-}5000}$	-1 dB		
$C_{tr,50\text{-}3150}$	-9 dB	$C_{tr,50\text{-}5000}$	-9 dB	$C_{tr,100\text{-}5000}$	-7 dB		

Name of test company : AF Acoustics
Signature:

FIGURE A5: SOUND INSULATION TEST BETWEEN THE RESTAURANT AND BEDROOM 2

APPENDIX B – TABLES

BS8233 Façade Sound Insulation Calculation

Reference: BS8233-001

Project	102-104 Kew Road, Richmond	Date	29-Oct-2019
Façade	Front	By	AF
Room	Living Room	Checked	GF

Symbol	Description	Ref	Units	Single Figure Rating	Octace Band Centre Frequency, Hz				
					125	250	500	1000	2000
S_f	Total façade area of room		m^2	18.2					
S_{wi}	Area of windows in façade		m^2	6.6					
S_{ew}	Area of external wall in façade		m^2	11.6					
S_{rr}	Area of ceiling exposed to external noise		m^2	0.0					
S	Total area of elements through which sound enters room		m^2	18.2					
A_0	Reference absorption area given in BS EN 20140-10		m^2	10.0					
	A-weighted free-field equivilent sound pressure level at measurement position		dB						
	Total propogation and angle of view correction from measurement to façade		dB	0.0					
$L_{Aq,ff}$	A-weighted free-field equivilent sound pressure level outside façade		dB						
$L_{TRAFFIC}$	Normalised road traffic noise spectrum derived from BS1793-3		dB						
$L_{eq,ff}$	Linear free-field equivilent sound pressure level outside façade		dB	**68.0**	**62**	**61**	**60**	**61**	**60**
$D_{n,e}$	Dn,e,w 37 dB	801	dB		36	37	37	34	37
R_{wi}	Sound reduction index of windows - 4/6/4 Glazing Pilikington	110	dB		21	17	25	35	37
R_{ew}	Sound reduction index of the external wall - Brick and block external wall (BS82	9	dB		40	44	45	51	56
R_{rr}	Sound reduction index of the roof/ceiling	94	dB		28	34	40	45	49
α	Room average alpha co-efficients (acoustically hard room)		-						
S_{room}	Room surface area		m2						
A	Equivilent absorption area of room		m^2		36	36	36	36	36
$L_{eq,2}$	Linear Internal reverberant sound pressure level in room		dB	42.4	37	40	31	27	23
	A-weighting Network				-16	-9	-3	0	1
$L_{eq,3}$	A-weighted internal reverberant sound pressure level in room		dB(A)	34.4	21.3	31.0	28.2	26.5	23.6
	Internal Criteria		dB(A)	**35.0**					
	Excess over criteria		dB(A)						

TABLE B1: INTERNAL NOISE CALCULATIONS FOR DAYTIME LIVING ROOM - FRONT

BS8233 Façade Sound Insulation Calculation

Reference: BS8233-001

Project	102-104 Kew Road, Richmond	Date	29-Oct-2019
Façade	Rear	By	AF
Room	Living Room	Checked	GF

Symbol	Description	Ref	Units	Single Figure Rating	Octace Band Centre Frequency, Hz				
					125	250	500	1000	2000
S_f	Total façade area of room		m^2	23.0					
S_{wi}	Area of windows in façade		m^2	4.5					
S_{ew}	Area of external wall in façade		m^2	18.5					
S_{rr}	Area of ceiling exposed to external noise		m^2	0.0					
S	Total area of elements through which sound enters room		m^2	23.0					
A_0	Reference absorption area given in BS EN 20140-10		m^2	10.0					
	A-weighted free-field equivilent sound pressure level at measurement position		dB						
	Total propogation and angle of view correction from measurement to façade		dB	0.0					
$L_{Aq,ff}$	A-weighted free-field equivilent sound pressure level outside façade		dB						
$L_{TRAFFIC}$	Normalised road traffic noise spectrum derived from BS1793-3		dB						
$L_{eq,ff}$	Linear free-field equivilent sound pressure level outside façade		dB	**70.3**	**67**	**64**	**62**	**60**	**57**
$D_{n,e}$	Dn,e,w 37 dB	801	dB		36	37	37	34	37
R_{wi}	Sound reduction index of windows - 10/6/4 Glazing Pilkington	115	dB		24	21	32	39	42
R_{ew}	Sound reduction index of the external wall - Brick and block external wall (BS82	9	dB		40	44	45	51	56
R_{rr}	Sound reduction index of the roof/ceiling	94	dB		28	34	40	45	49
α	Room average alpha co-efficients (acoustically hard room)		-						
S_{room}	Room surface area		m2						
A	Equivilent absorption area of room		m^2		17	17	17	17	17
$L_{eq,2}$	Linear Internal reverberant sound pressure level in room		dB	44.1	41	40	30	27	21
	A-weighting Network				-16	-9	-3	0	1
$L_{eq,3}$	A-weighted internal reverberant sound pressure level in room		dB(A)	34.6	25.4	31.2	27.1	27.4	22.0
	Internal Criteria		dB(A)	**35.0**					
	Excess over criteria		dB(A)						

TABLE B2: INTERNAL NOISE CALCULATIONS FOR DAYTIME LIVING ROOM - REAR

BS8233 Façade Sound Insulation Calculation

Reference: BS8233-001

Project	102-104 Kew Road, Richmond	Date	29-Oct-2019
Façade	Rear	By	AF
Room	Bedroom	Checked	GF

Symbol	Description	Ref	Units	Single Figure Rating	Octace Band Centre Frequency, Hz				
					125	250	500	1000	2000
S_f	Total façade area of room		m^2	22.1					
S_{wi}	Area of windows in façade		m^2	3.0					
S_{ew}	Area of external wall in façade		m^2	19.1					
S_{rr}	Area of ceiling exposed to external noise		m^2	0.0					
S	Total area of elements through which sound enters room		m^2	22.1					
A_0	Reference absorption area given in BS EN 20140-10		m^2	10.0					
	A-weighted free-field equivilent sound pressure level at measurement position		dB						
	Total propogation and angle of view correction from measurement to façade		dB	0.0					
$L_{Aq,ff}$	A-weighted free-field equivilent sound pressure level outside façade		dB						
$L_{TRAFFIC}$	Normalised road traffic noise spectrum derived from BS1793-3		dB						
$L_{eq,ff}$	Linear free-field equivilent sound pressure level outside façade		dB	**66.0**	**62**	**60**	**59**	**57**	**54**
$D_{n,e}$	Dn,e,w 40 dB	802	dB		36	37	37	40	42
R_{wi}	Sound reduction index of windows - 10/6/4 Glazing Pilkington	115	dB		24	21	32	39	42
R_{ew}	Sound reduction index of the external wall - Brick and block external wall (BS82	9	dB		40	44	45	51	56
R_{rr}	Sound reduction index of the roof/ceiling	94	dB		28	34	40	45	49
α	Room average alpha co-efficients (acoustically hard room)		-						
S_{room}	Room surface area		m2						
A	Equivilent absorption area of room		m^2		14	14	14	14	14
$L_{eq,2}$	Linear Internal reverberant sound pressure level in room		dB	39.2	36	36	27	20	15
	A-weighting Network				-16	-9	-3	0	1
$L_{eq,3}$	A-weighted internal reverberant sound pressure level in room		dB(A)	29.8	20.0	26.8	23.8	20.1	15.7
	Internal Criteria		dB(A)	**30.0**					
	Excess over criteria		dB(A)						

TABLE B3: INTERNAL NOISE CALCULATIONS FOR NIGHT TIME BEDROOMS

APPENDIX C: ACOUSTIC SPECIFICATION FOR WINDOWS

Windows, including all glazed elements fixed, and openable sections, related framework mullions, transoms and where applicable, furniture, all as are intended to be included within living rooms and bedrooms shall provide an airborne sound insulation index rating of not less than the following:

Room Type	Glazing Sound Reduction
Living Room front	25 dB $R_W + C_{tr}$
Living room and Bedroom rear facing	30 dB $R_W + C_{tr}$

Performance shall be as measured in accordance with BS EN ISO 140-3:1995 and rated in accordance with BS EN ISO 717-1:1997, and evidence to this effect shall be published as part of the tender response.

	Octave Band Centre Frequency					
	125	250	500	1k	2k	4k
	Sound Reduction Index (R), dB					
25 dB $R_w + C_{tr}$	21	17	25	35	37	21
30 dB $R_w + C_{tr}$	24	21	32	39	42	43

APPENDIX D: ACOUSTIC SPECIFICATION FOR VENTILATORS

Ventilators, including all fixed and openable sections and related framework, all as are intended to be included within any part of the building façade, shall provide a weighted element-normalised level difference ($D_{n,e,w}$) of not less than the following:

Façade	Item	Item
Living Room front and rear	Acoustic Trickle Vent	$D_{n,e,w}$ 37dB
Bedrooms	Acoustic Trickle Vent	$D_{n,e,w}$ 40dB

Performance shall be measured in accordance with BS EN 20140-10:1992 and rated in accordance with BS EN ISO 717-1:1997, and evidence to this effect shall be published as part of the tender response.

Elements, as described above, shall further offer not less than the minimum element-normalised level difference ($D_{n,e}$) when measured in accordance with BS EN 20140-10:1992 shown below:

	Octave Band Centre Frequency					
	125	250	500	1k	2k	4k
	Sound Reduction Index (R), dB					
$D_{n,e,w}$ 37 dB	36	37	37	34	37	37
$D_{n,e,w}$ 40 dB	36	37	37	40	42	42

Should laboratory acoustic performance information be unavailable or be unrepresentative for the configurations required, or a pre-tender laboratory testing cannot be accommodated within the tender submittal and evaluation timescale, the contractor's submittal must be supported by third part calculation of sufficient detail to show attenuation contributions arising from framing and suchlike features at tender submittal stage. In this event, the successful tenderer shall be required to promptly undertake laboratory testing and rating to demonstrate conformance of particular test pieces, yet to be selected, with this specification and to make available such substantive evidence to and agreed timescale and at the tender's cost.

APPENDIX E: TERMINOLOGY RELATING TO NOISE

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20_{μ}Pa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power Level (Lw)	is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).
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_{μ}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.
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound
$L_{90,T}$	L_{90} is the noise level exceeded for 90% of the period T (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
$L_{max,T}$	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.
Specific Noise	The noise source under investigation for assessing the likelihood of complaints.
Rating Level	The specific noise level plus any adjustment for the characteristic features of the noise.
Free field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade	At a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX E: LIMITATIONS TO THE REPORT

This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of AF Acoustics Ltd. AF Acoustics Ltd accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/or AF Acoustics Ltd and agree to indemnify AF Acoustics Ltd for any and all loss or damage resulting therefrom. AF Acoustics Ltd accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

The findings and opinions expressed are relevant to the dates of the site works and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations AF Acoustics Ltd reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.