

Acoustic Associates Sussex Ltd

Discharge of Planning Condition 4 of LU/321/17/PL BS 8233:2014 Assessment

Site: 22 Beach Road, Littlehampton, West Sussex. BN17 5HT
Client: Darren Godfrey

Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics MIOA

Date: 20/09/2019

Project: J2707

Issue 1



Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPG24 - Schools Acoustics BS83 -
Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

Part of the Acoustic Associates Group of consultancies:

DEVON HUMBERSIDE LEICESTERSHIRE NOTTINGHAMSHIRE PETERBOROUGH SUSSEX WESSEX WORCESTERSHIRE

Contents

1	Introduction and Executive Summary	- 3 -
2	Context, Noise Criteria & Noise Assessment Methodology	- 4 -
2.1	Context	- 4 -
2.2	Location and Commercial context.	- 4 -
2.3	Location of the Condenser Units serving the Walk in Chiller.....	- 6 -
2.4	Pizza Hut Flue – Vertical Termination	- 7 -
2.5	British Standard 8233:2014 - Guidance on sound insulation and noise reduction for Buildings-	8 -
2.6	Soundscape.....	- 8 -
2.7	Methodology and Approach	- 8 -
3	Measured Ambient Noise Levels	- 9 -
3.1	Survey Details	- 9 -
3.2	Reverberation Time Testing and Corrections to measured values.....	- 10 -
3.3	Flat 1.....	- 11 -
3.4	Flat 2.....	- 12 -
4	Discussion	- 14 -
4.1	Reverberation Time Adjustment	- 14 -
4.2	Fan Speeds	- 15 -
4.3	Condition 3 of LU/56/17/PL.....	- 15 -
5	Ventilation	- 16 -
6	Uncertainty	- 17 -
7	Noise Mitigation Measures	- 17 -
8	Conclusion	- 17 -

Tables and Figures

Table 1.	BS8233:2014, Table 4 requirements	- 8 -
Table 2.	Survey equipment used.....	- 9 -
Table 3.	Reverberation Time Values (T20) for the three bedrooms tested.	- 11 -
Figure 1.	Location of 22 Beach Road, Littlehampton.	- 5 -
Figure 2.	Site Location Plan	- 5 -
Figure 3.	Proposed Internal Layout of first and second floor	- 6 -
Figure 4.	Location of Condensers serving Walk in Chiller	- 6 -
Figure 5.	Pizza Hut Vertical Discharge Flue	- 7 -
Figure 6.	Internal Measurement Positions	- 9 -
Figure 7.	Internal Measurement Positions in Plan View	- 10 -

Figure 8. Bedroom. Flat 1 to Rear.	- 11 -
Figure 9. Review of 1-hour periods inside Flat 1 bedroom	- 12 -
Figure 10. Flat 2, Rear bedroom, daytime and Night-time Values	- 12 -
Figure 11. Review of 1-hour periods inside Flat 2, rear bedroom during the daytime period.	- 13 -
Figure 12. Flat 2, Bedroom overlooking Beach Road	- 13 -
Figure 13. Revised Internal Sound Levels for Flat 2 front Bedroom overlooking Beach Road.	- 14 -
Figure 14. Flat 1 bedroom, fan speed change in sound levels	- 15 -
Figure 15. Greenwood Acoustically Attenuated Trickle Vent	- 16 -

Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics MIOA
Checked by: Peter Attwood BSc MSc MCIOB MIOA MIDiagE

Issue 1	06/06/2019	Original Issue
Issue 2	20/09/2019	Revised

This report has been prepared for the private and confidential use of Darren Godfrey only and cannot be reproduced in whole or in part or relied upon by any third party for any use whatsoever without the express written authorisation of Acoustic Associates Sussex Ltd. If any third party whatsoever comes into possession of this report, they rely on it at their own risk and Acoustic Associates Sussex Ltd accepts no duty or responsibility (including in negligence) to any such third party

1 Introduction and Executive Summary

Acoustic Associates have been appointed to undertake an acoustic assessment relating to the internal testing of three converted flats at 22 Beach Road, Littlehampton. The flats are recently converted from a larger house and have achieved planning consent albeit within conditions to be discharged prior to occupation. The purpose of the assessment was as follows:

- Measure and assess existing internal sound noise levels against BS8233:2014

Noise levels have been assessed in terms of and following the guidelines of BS8233:2014 - Guidance on sound insulation and noise reduction for buildings

Two class one sound level meters measured sound levels at three positions inside 22 Beach Road, Littlehampton, at the first-floor converted flats. Measurements were made in the bedroom in flat 1 to the rear (West) and two bedrooms in flat 2 (East), with microphones in rooms measuring both the rear bedroom closest to the Pizza Hut extract ductwork and the bedroom overlooking Beach Road and experiencing road traffic noise. The internal survey was undertaken from 10th May 2019 to 14th May 2019 over a busy weekend period to present a robust and worst-case reporting period.

As the rooms were not finished and largely reverberant, reverberation times were measured in the three bedrooms to calculate any corrections needed to represent furnished or lived in properties with greater absorption.

The results gathered indicated that the bedrooms measured to the rear of 22 Beach Road in close proximity to the Pizza Hut extract fan all met the daytime and night time requirements of BS8233:2014. In the case of the flat 2 bedroom, this met the standard with the window left cracked open.

The flat 2 bedroom overlooking Beach Road was noted to exceed the initial requirements of BS8233:2014 with the windows closed, however, when adjustments were made for absorption and a 5dB(A) relaxation applied as advocated in BS8233:2014 (7.7.2), the requirements have been met for both daytime (relaxed standard) and night time (30dB L_{Aeq,8 hour}).

In view of the above testing conditions and the data presented, it is considered that the requirements of condition 4 have been met and may be discharged by the local planning authority. It is also considered that condition 3 of LU/56/17/PL is no longer applicable, as the Pizza Hut extraction system has been assessed against the nearest flats with windows open and with changes in fan speeds reported, without adverse impact to the residential amenity of the flats above 22 Beach Road.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

Planning consent (LU321/17/PL) has permitted the change of use from upper floors from 1 dwelling into 3 smaller flats. It is relevant to note that the application site was already residential and is being split into smaller flats over two levels (first and second floor).

In particular, the local planning authority at Arun District Council have conditioned that the internal sound levels inside the flats meet the requirements of BS8233:2014. The specific wording of condition 4 is seen below.

4 Prior to occupation of the flats hereby approved an acoustic report based upon actual readings on site, which demonstrates that the internal noise levels of the proposed residential units will conform to indoor ambient noise levels for dwellings as specified within BS8233:2014. Guidance on Sound Insulation and Noise Reduction for Buildings shall be submitted to and approved by the Local Planning Authority. The details shall include any mitigation measures which may prove necessary to be specified. Any works specified in the approved scheme shall then be carried out in accordance with the approved details prior to occupation of the premises and retained thereafter to the satisfaction of the Local Planning authority.

Reason: To safeguard the amenities of nearby residents in accordance with Arun District Local Plan policies GEN7 and GEN32.

It is also noted that condition 3 of a separate planning application (LU/56/17/PL) determined on 30 May 2017 requires as follows:

"3. Before the development commences, the applicant shall submit a report, prepared in accordance with the provisions of BS4142 to predict noise levels generated by the machinery and plant to be operated on site at the nearest noise sensitive location."

Condition 3 of LU/56/17/PL will be considered further in section 4.3.

2.2 Location and Commercial context.

22 Beach Road consists of a Pizza Hut kitchen and takeaway premises at the ground floor, and residential flats at first and second floors above the premises. To the South is an antiques shop and to the North, an optician's shop and a carpet shop. Opposite Pizza hut is a beauty salon, a supermarket and furnishings store.

A pedestrianised rear area known as Evans Gardens exists to the West and contains three shops accessed via foot including a shop for infant clothes, a gym studio and an arts studio. The site can be seen in Figure 1 below with the residential windows marked in red.

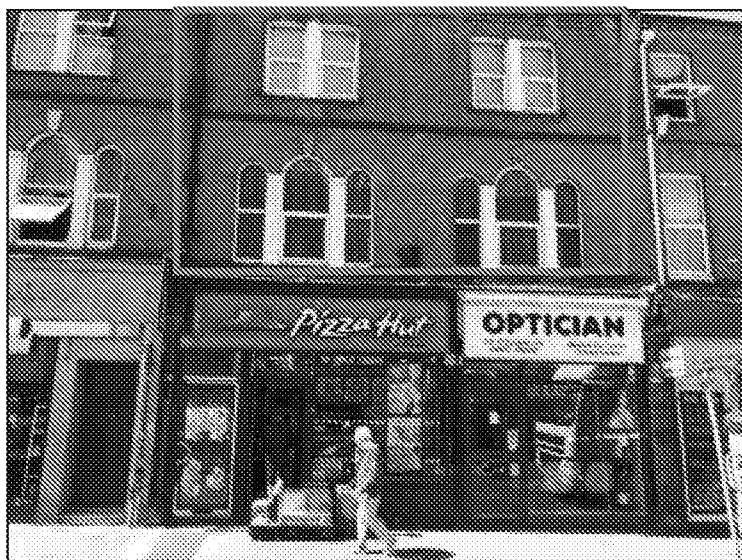


Figure 1. Location of 22 Beach Road, Littlehampton.

Pizza Hut is open from 12:00 to 23:00 hours daily and is a takeaway premises only, where the pizzas are cooked, without any diners. The extraction system is switched off at 23:00 hours daily. Beach Road is a single carriageway (30mph) one-way street which has parking and/or loading bays on both sides of the street. The site is shown in plan in Figure 2 below with Evans Gardens to the rear.

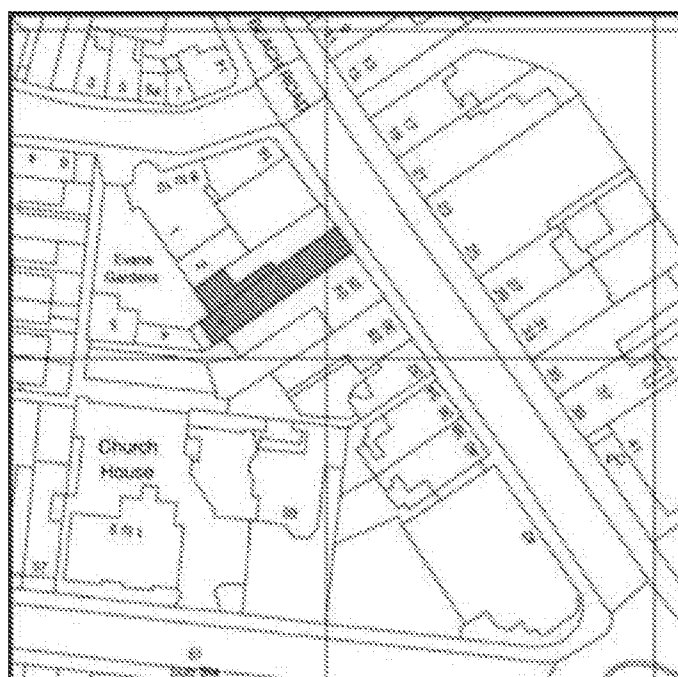


Figure 2. Site Location Plan

The proposed internal layout for the first and second floor is seen in Figure 3 below.

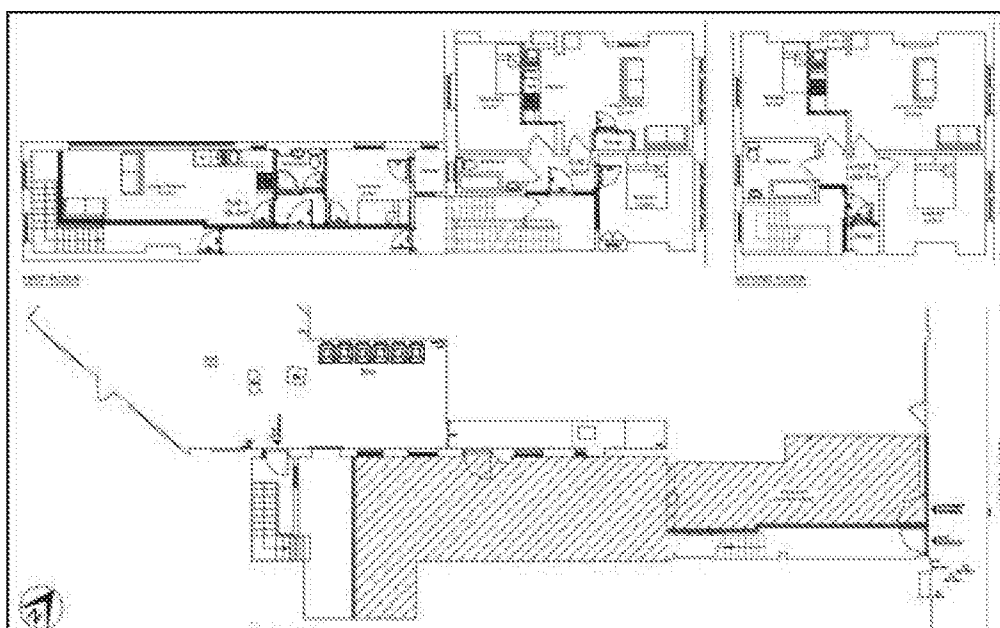


Figure 3. Proposed Internal Layout of first and second floor

2.3 Location of the Condenser Units serving the Walk in Chiller

The condensers were previously located below the bedroom window but have since been relocated to inside the rear garage unit at the very rear of Flat 1, outside the demise of the flat.

The condensers are mounted on anti-vibration mounts on the ground floor. Both the garage and the pizza hut ceiling were soundproofed at the same time. The condenser positions inside the garage void are shown below.

The condensers would have run as part of the survey and are contained with the survey data.

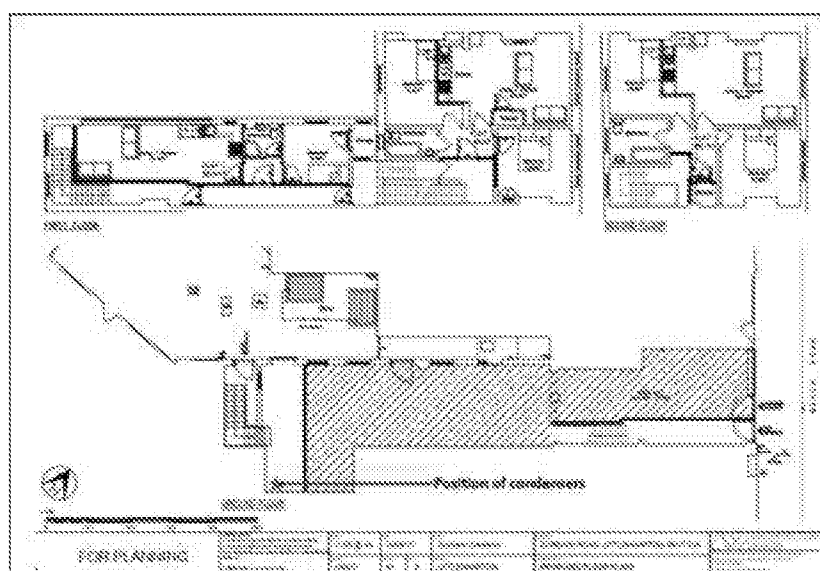


Figure 4. Location of Condensers serving Walk in Chiller

2.4 Pizza Hut Flue – Vertical Termination

Flat 3 is located on the second floor with the extract ductwork passing at exactly the same position as the first floor, where the flat 2, rear bedroom was examined.

The top flat is closer to the termination point which discharges, upwards, well above the 2nd floor windows.

However, the first-floor window was considered worst case warranting measurement due to the more enclosed nature of the first floor at the rear of the building (reflections from flat roof and walls) and the fact that the first-floor windows were closer to the kitchen extract plant.

A further reason, which informed the decision to survey the first floor, was to ensure that direct noise transfer, through floor from kitchen/customer areas, was also at an acceptable level.

A site photograph below shows the existing ductwork and importantly that the termination point is well away from the bedroom window and above eaves. Whilst present on site, Flat 3 was visited and subjectively listened to, before determining where to set up the various survey instruments. The rationale behind the selection of survey positions was already detailed within the report.



Figure 5. Pizza Hut Vertical Discharge Flue

2.5 British Standard 8233:2014 - Guidance on sound insulation and noise reduction for Buildings

It is relevant to consider what the British Standard referenced in condition 4 requires.

Table 4 of BS8233:2014 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB L _{Aeq,16hour}	-
Dining	Dining Room/Area	40dB L _{Aeq,16hour}	-
Sleeping (daytime resting)	Bedroom	35dB L _{Aeq,16hour}	30dB L _{Aeq,8hour}

Table 1. BS8233:2014, Table 4 requirements

The British Standard also has a note in 7.7.2 that states “Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved”. Given that the site was already a residential dwelling, it is felt that the relaxation is applicable in this instance.

2.6 Soundscape

2.6.1 Beach Road

The first-floor bedroom and lounge overlooking Beach road (Flat 2) were dominated by passing road traffic noise.

2.6.2 Pizza Hut Extract Ductwork

At the time of installing and decommissioning the survey equipment, the extract system serving the pizza hut kitchen was operational. Subjectively, it did not change in character, ran continuously and was not tonal or intrusive. Even listening with the flat 2 rear bedroom window wide open, the fan noise could only just be heard.

2.6.3 Evans Gardens

It was noted on setting up the survey equipment that construction works were occurring inside Panama Joes, at the junction of Evans Gardens and Arcade Road.

2.7 Methodology and Approach

Internal sound levels were measured using a 01dB laptop with dual microphones which log every 1 second. Given that the major importance is the bedroom environment with a stricter target to be met overnight in BS8233:2014, a bedroom in flat 1 and two bedrooms in flat 2 were selected for continuous measurements. Both flats are located on the first floor as the storey most likely to be impacted and receive the highest noise levels. Rationale for room selection is also discussed above in section 2.4.

The Beach Road facing bedroom had a window closed and the bedroom closest to the extraction system was placed on the night latch allowing sufficient ventilation.

As empty rooms and prior to furnishing and fixtures being introduced, the rooms do not have any finishes which will absorb sound energy and are largely reverberant. The Reverberation Time (RT), or rather the time taken for the sound energy to decay by 60 decibels was measured in each of the measurement bedrooms to allow a more representative consideration of what the sound levels of the rooms might be when occupied.

3 Measured Ambient Noise Levels

An unattended sound survey was carried out inside Flats 1 and 2 at 22 Beach Road between the 10th May 2019 to 14th May 2019 to assess the internal sound levels inside the three first-floor bedrooms. The duration of the survey was sufficient to collect data for four full nights over what would be the busiest weekend period and three and a half days.

The measurement positions presented a worst-case situation with the focus on examination of the bedrooms with the following rationale.

1. Flat 1, Bedroom above pizza hut kitchen area and overlooking rear of 22 Beach Road.
2. Flat 2, Front bedroom overlooking Beach Road. Window Closed.
3. Flat 2, Bedroom overlooking the rear of 22 Beach Road, closest to Pizza Hut extract vent. Window Open.

3.1 Survey Details

Survey(s) carried out by	Scott Castle BSc (Hons) Env Health, MCIEH CEnvH PGDip Acoustics MIOA
Equipment Used	01dB Symphonie System – Class 1 Sound Level Meter
Equipment Used	01dB SIP 95 – Class 1 Sound Level Meter
Equipment Used	Rion Calibrator – Serial Number (50241778)
Location of Microphones	Symphony Microphone A – Flat 2 Front Bedroom Symphony Microphone B – Flat 2 Rear Bedroom 01dB SIP95 – Flat 1 Bedroom
Duration of Survey	13:00 hours 10/5/2019 to 15:50 hours 14/5/2019

Table 2. Survey equipment used

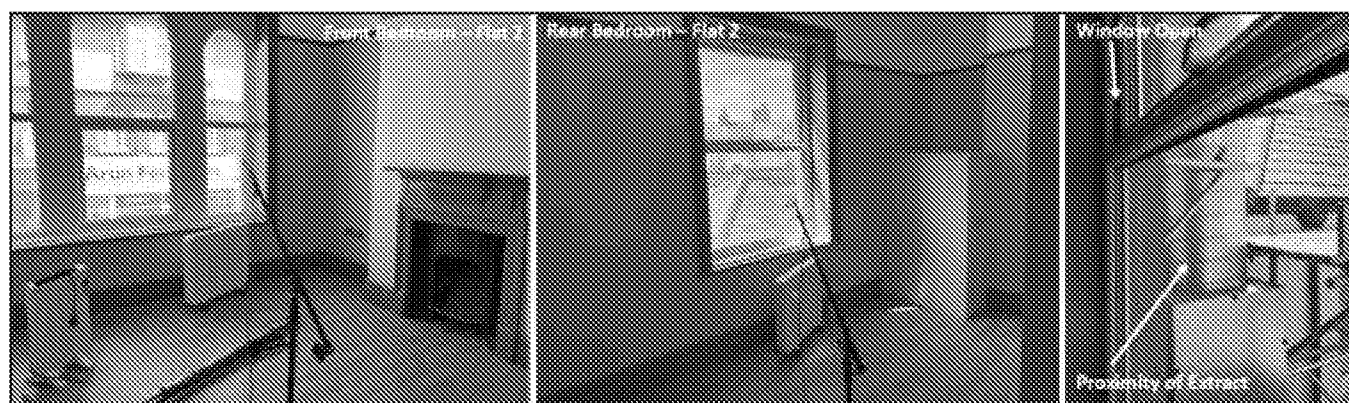


Figure 6. Internal Measurement Positions

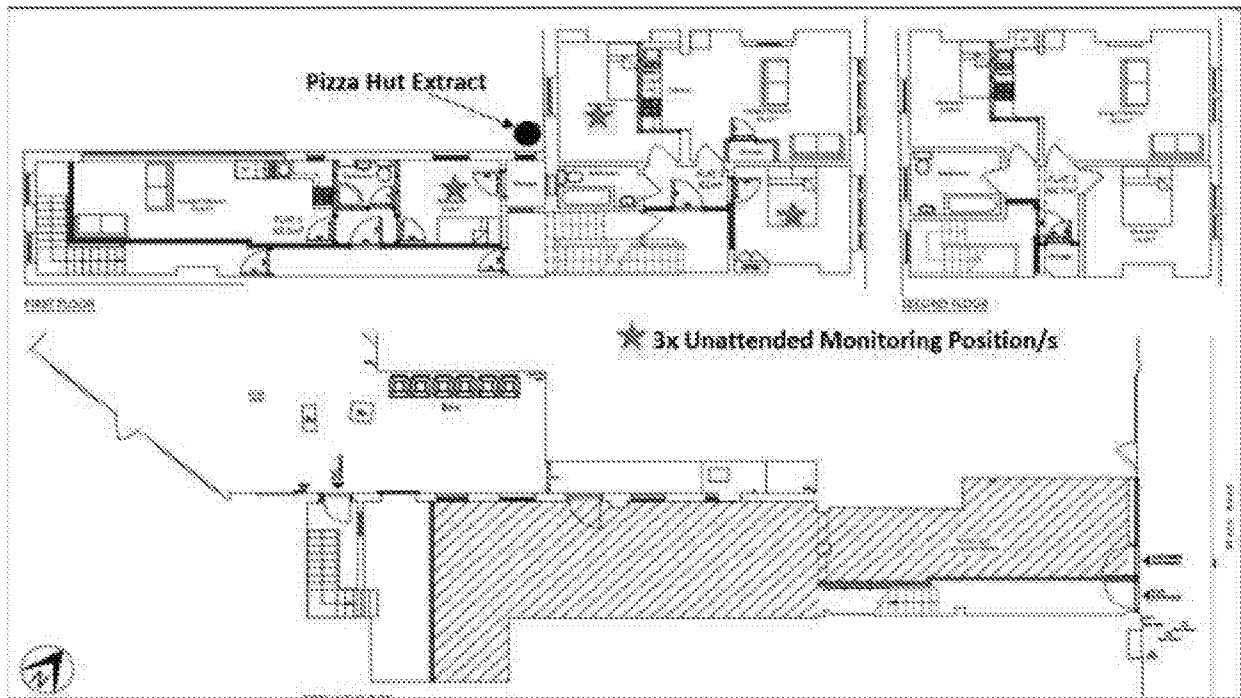


Figure 7. Internal Measurement Positions in Plan View

The sound level meters were calibrated before and after commencing the noise measurements (@94dB no drift). The parameter used were Fast and A weighted. All measurements were taken with the time base set to 1 second logging to allow subsequent processing through the dB Trait Software.

3.2 Reverberation Time Testing and Corrections to measured values

Given that the test bedrooms were empty and devoid of furnishings likely to absorb sound energy (carpet, bed, linen, curtains etc), a number of reverberation time (RT) measurements were made inside the three bedrooms to ensure that corrections could be applied to the recorded sound levels. The measurements were made using a single JBL loudspeaker to broadcast a loud sound signal and recording the time taken for the signal energy to decay by 60dB. The measurements are noted below with any appropriate correction to be applied to the recorded sound levels. The T20 results are used for the spectra from 100Hz to 3150Hz accordingly, in line with the approach of Approved Document E for Building Regulations and are shown in Table 3 below with the arithmetic average for the six locations tested within each room for each octave band.

Location	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	Total
Back bedroom - Flat 2	0.56	0.77	0.57	1.22	1.06	1.16	0.97	1.34	1.21	1.13	1.1	1.14	1.04	0.93	0.95	0.87	
Back bedroom - Flat 2	0.48	0.71	0.58	1.11	0.98	1.18	0.99	1.09	1.22	1.37	1.15	1.21	1.02	0.84	0.89	0.99	
Back bedroom - Flat 2	0.54	0.85	0.56	1.04	1.14	1.06	0.97	1.26	1.15	1.19	0.99	1	1.11	0.88	0.9	0.84	
Back bedroom - Flat 2	0.57	0.62	0.87	0.93	0.83	0.8	0.98	1.53	1.45	1.53	1.46	1.13	1.25	0.99	1.04	1.07	
Back bedroom - Flat 2	0.39	0.49	0.99	1.09	0.83	0.91	1.23	1.38	1.47	1.26	1.46	1.18	1.15	1.11	1.09	1.1	
Back bedroom - Flat 2	0.51	0.58	0.9	0.85	1.12	0.92	1.17	1.03	1.36	1.54	1.35	1.25	1.25	1.12	1.08	1.09	
Arithmetic Average	0.5	0.7	0.7	1.0	1.0	1.0	1.1	1.3	1.3	1.3	1.3	1.2	1.1	1.0	1.0	1.0	1.0
Front Bedroom - Flat 2	0.75	0.54	0.73	0.77	0.83	1.14	1.26	1.39	1.38	1.4	1.2	1.25	1.26	1.07	1.02	1.07	
Front Bedroom - Flat 2	0.76	0.89	0.63	0.39	0.97	0.98	0.9	1.35	1.1	1.34	1.27	1.31	1.21	0.97	0.95	1.19	
Front Bedroom - Flat 2	0.7	0.65	0.79	1.11	1.19	1.16	1.15	1.46	1.5	1.18	1.18	1.21	1.03	1.1	1.05	1.01	
Front Bedroom - Flat 2	0.74	0.54	0.67	0.98	1.23	1.16	1.29	1.19	1.2	1.24	1.2	1.36	1.04	1.01	1.1	1.15	
Front Bedroom - Flat 2	0.41	0.75	0.58	0.78	1.02	1.04	1.03	1.05	1.36	1.2	1.19	1.15	1.16	0.99	0.97	1.11	
Front Bedroom - Flat 2	0.71	0.59	0.96	1.04	1.05	1.2	0.95	1.22	1.33	1.26	1.4	1.21	1.2	1.03	0.98	1.02	
Arithmetic Average	0.7	0.7	0.7	0.8	1.0	1.1	1.1	1.3	1.3	1.3	1.2	1.2	1.2	1.0	1.0	1.1	1.0
Only Bedroom - Flat 1	0.52	0.62	0.52	0.89	0.84	0.61	0.84	0.63	0.59	0.73	0.67	0.79	0.7	0.68	0.59	0.66	
Only Bedroom - Flat 1	0.27	0.66	0.53	0.48	0.5	0.53	0.51	0.92	0.92	0.89	0.64	0.74	0.68	0.68	0.76	0.62	
Only Bedroom - Flat 1	0.49	0.78	0.42	0.45	0.49	0.57	0.74	0.55	0.81	0.83	0.83	0.73	0.75	0.65	0.65	0.58	
Only Bedroom - Flat 1	0.6	0.75	0.6	0.41	0.5	0.48	0.59	0.64	0.66	0.82	0.74	0.64	0.84	0.7	0.53	0.63	
Only Bedroom - Flat 1	0.35	0.64	0.76	0.74	0.46	0.63	0.88	0.75	0.74	0.71	0.71	0.74	0.66	0.73	0.63	0.67	
Only Bedroom - Flat 1	0.25	0.59	0.64	0.81	0.6	0.69	0.46	0.8	0.69	0.76	0.74	0.79	0.83	0.61	0.73	0.64	
Arithmetic Average	0.4	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.7

Table 3. Reverberation Time Values (T20) for the three bedrooms tested.

Note that the two bedrooms in flat 2 were considerably more reverberant than the single bedroom in flat 1 i.e., over 1 second compared to 0.7 seconds (rounded).

3.3 Flat 1

Flat 1 is located to the rear of the site on the first floor and only has a single bedroom. The laminate floor was still to be laid and the window was closed for the duration of the monitoring. The flat was directly above the Pizza Hut kitchen area. The data obtained from the 01dB SIP95 is shown in Figure 6 below and clearly meets the requirements of BS8233:2014. The bedroom door was closed during the testing. The data was analysed for one-hour intervals with these being logarithmically averaged.

Logarithmically Averaged Day and Night time Periods			
L _{Aeq} , 16 hour 07:00-23:00		L _{Aeq} , 8 hour 23:00-07:00	
Day 1*	30.2	Night 1	19.0
Day 2	29.4	Night 2	19.7
Day 3	29.0	Night 3	19.1
Day 4	28.6	Night 4	19.0
Day 5*	26.6	N/A	
Arithmetic Average	28.8	Arithmetic Average	19.2
Day1* and Day 5* were incomplete 16 hour periods			

Figure 8. Bedroom. Flat 1 to Rear.

Reviewing the one-hour data for inside the bedroom of Flat 1, it is apparent that the sound level increases between 11:00-12:00 hours when the fan is switched on around 11:30 before a test pizza commences at 12:00 hours for normal service. This is commensurate with day to day operations.

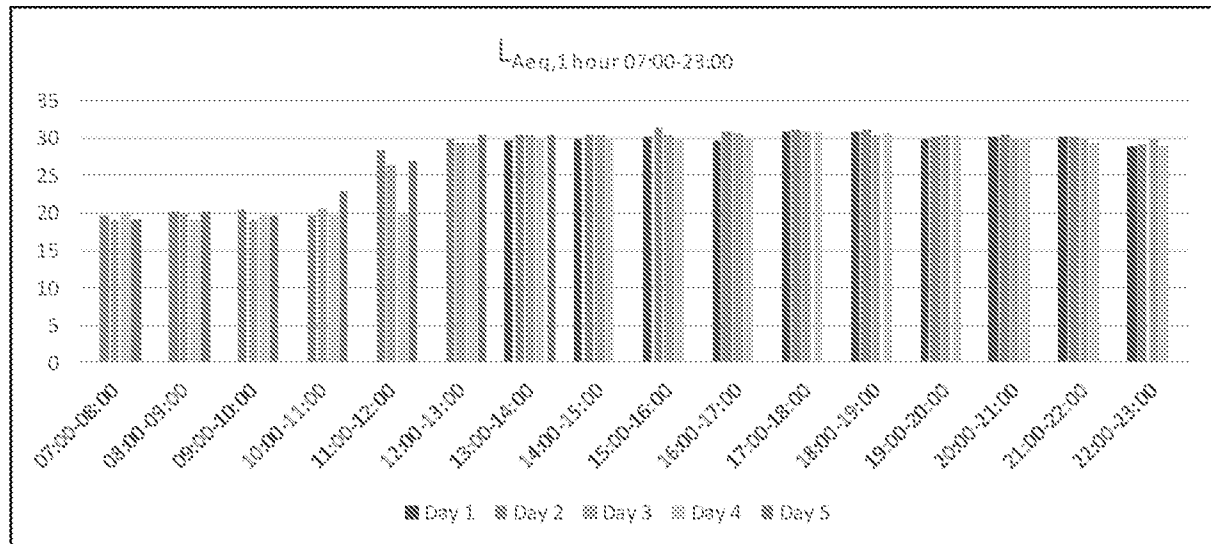


Figure 9. Review of 1-hour periods inside Flat 1 bedroom

3.4 Flat 2.

Within Flat 2, there are 2 bedrooms, one overlooking Beach Road to the East and one bedroom overlooking the rear yard and looking West, closest to the Pizza Hut extract. As discussed above, for the worst-case rear bedroom in close proximity to the Pizza Hut extract, the window was left on the night latch allowing fresh air into the bedroom. The test conditions were with the bedroom doors closed.

3.4.1 Rear Bedroom

The results for the rear bedroom were noted as follows in Figures 8 and 9 below. The rear bedroom easily meets BS8233:2014 for both the daytime and night time periods and is noted to meet the British Standard with the window open. The daytime hours in Figure 9 below show the daytime levels at just below 30 prior to 12:00 hours when the fan would be switched on.

Logarithmically Averaged Day and Night time Periods			
L _{Aeq, 16 hour} 07:00-23:00		L _{Aeq, 8 hour} 23:00-07:00	
Day 1*	34.7	Night 1	27.5
Day 2	31.7	Night 2	28.1
Day 3	31.3	Night 3	27.3
Day 4	31.4	Night 4	27.0
Day 5*	32.2	N/A	
Arithmetic Average	32.3	Arithmetic Average	27.5
Day1* and Day 5* were incomplete 16 hour periods			

Figure 10. Flat 2, Rear bedroom, daytime and Night-time Values

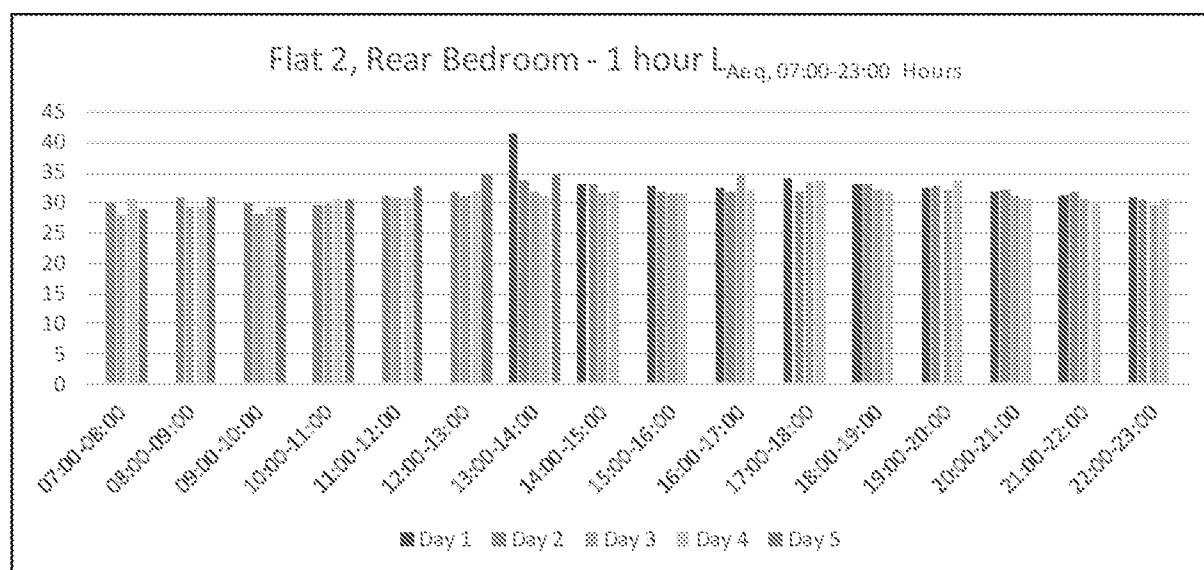


Figure 11. Review of 1-hour periods inside Flat 2, rear bedroom during the daytime period.

3.4.2 Front Bedroom

Data taken from the bedroom overlooking Beach Road was done so with the window closed and the room was noted to be reverberant as discussed in 3.2 above.

Figure 10 below presents the recorded data and indicates that for the complete measurement periods (i.e. those with a full 16-hour daytime data collection) for the daytime, the worst case is that the room is 5dB(A) above the stated internal requirements for BS8233:2014. For the night time period, the arithmetic average is 2dB above the internal requirement.

Logarithmically Averaged Day and Night time Periods			
	$L_{Aeq, 16 \text{ hour } 07:00-23:00}$		$L_{Aeq, 8 \text{ hour } 23:00-07:00}$
Day 1*	42.6	Night 1	32.8
Day 2	40.2	Night 2	31.2
Day 3	39.6	Night 3	32.4
Day 4	38.6	Night 4	31.4
Day 5*	44.8	N/A	
Arithmetic Average	41.1	Arithmetic Average	31.9
Day1* and Day 5* were incomplete 16 hour periods			

Figure 12. Flat 2, Bedroom overlooking Beach Road

4 Discussion

The only cause for concern is the front bedroom of flat 2 overlooking Beach Road. It is noted that the site was already a single residential property which has now been converted into three self-contained flats.

It is also relevant to reflect that the smaller bedroom overlooking Beach Road was considered to be the worst case in that the size of the room in comparison to the glazed element were small and additionally, exposure was considered in close proximity to road traffic noise at the first-floor level which will always present an increased sound level.

The highest internal sound level from the complete data periods were 40dB $L_{Aeq, 16 \text{ hour}}$ during the daytime, i.e. 5dB above the internal criteria and 33dB $L_{Aeq, 8 \text{ hour}}$ for the night time period, 3dB above the internal criteria stated in BS8233:2014.

4.1 Reverberation Time Adjustment.

It is noted that none of the test rooms contained any soft furnishings or fabrics which would be present when future occupiers are living in the flats. Using the arithmetic average of the 100Hz to 3150Hz range provides 1.04979 seconds, making the room very live and reverberant. To calculate the adjustment in sound levels, the broadband time in seconds is divided by 0.5 and multiplied by 10log to determine a suitable subtraction from the dataset to account for future conditions.

The correction term is therefore $10\log(1.04979/0.5) = 3.22133$.

A suitable subtraction to account for soft furnishings and finishes is 3.22dB. The revised data for the front bedroom in Flat 2 is shown in Figure 11 below.

Logarithmically Averaged Day and Night time Periods			
$L_{Aeq, 16 \text{ hour } 07:00-23:00}$		$L_{Aeq, 8 \text{ hour } 23:00-07:00}$	
Day 1*	39.4	Night 1	29.5
Day 2	37.0	Night 2	28.0
Day 3	36.4	Night 3	29.2
Day 4	35.4	Night 4	28.1
Day 5*	41.5	N/A	
Arithmetic Average	37.9	Arithmetic Average	28.7
Day1* and Day 5* were incomplete 16 hour periods			

Figure 13. Revised Internal Sound Levels for Flat 2 front Bedroom overlooking Beach Road.

The revised calculation for the front room in Flat 2 which was above the British Standard 8233:2014 is therefore only 1.3 dB above for the daytime period (when considering only the complete 16-hour daytime periods) and the night time period is also considered to be met.

In applying the 5dB relaxation as advocated in 7.7.2 of BS8233:2014, the daytime standard is considered to be met, as well as the night time criterion meeting the higher standard of 30dB $L_{Aeq, 8 \text{ hour}}$. As per 2.3 above, it is considered that given the former residential use of the site, that a relaxation is applicable. Notwithstanding the relaxed levels, the criteria laid out in Table 4 of BS8233:2014 is only 1.3dB above daytime levels (35dB $L_{Aeq, 16 \text{ hour}}$) for a bedroom environment with the night time period also meeting 30dB $L_{Aeq, 8 \text{ hours}}$.

4.2 Fan Speeds

Reference was made to ensuring that the Pizza Hut fan speeds for the extract ductwork were included within the supporting data. Accordingly, the fan speeds were increased at the time of collecting the survey equipment with the results captured inside the bedroom of Flat 1. It is important to note that the fan is never run at full speed and remains a constant and continuous sound. The fan and motor for the ductwork are located close to the extract canopy inside the restaurant premises on the ground floor.

The SIP95 in Flat 1 bedroom was used to assess the difference between the fan speed operating at normal levels and the maximum speed as detailed in Figure 12 below.

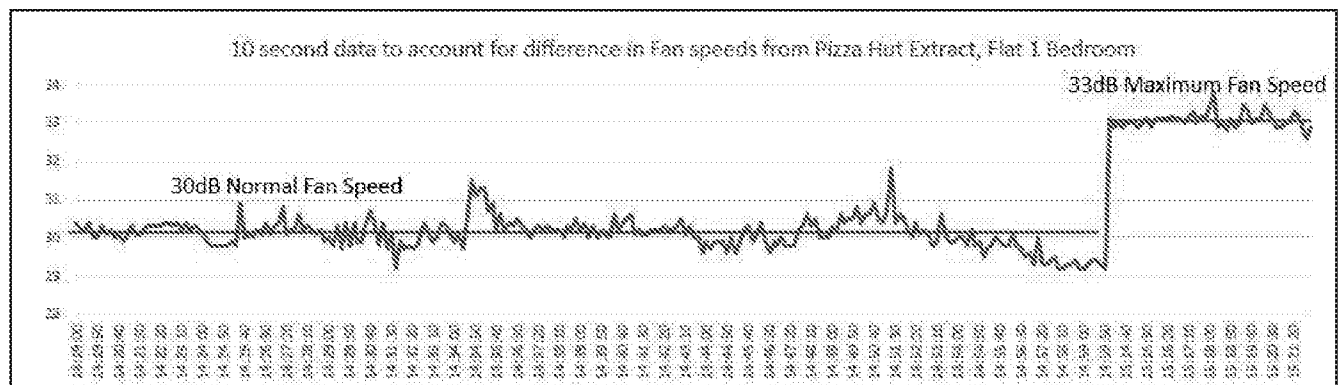


Figure 14. Flat 1 bedroom, fan speed change in sound levels

It is noted that the increased fan speed caused a 3dB increase internally, however, it is important to reflect that the fan is never used at 100%. With a 3dB increase inside the bedroom in Flat 1, the daytime sound criterion in BS8233:2014 is still achieved. It is noted that the fan stops at 23:00 hours.

4.3 Condition 3 of LU/56/17/PL

It was noted by the client that condition 3, as detailed in 2.1 above, requires a BS4142:2014 assessment. The application of such a condition by the local planning authority is designed to provide an understanding of the impact of introducing new commercial plant with a view to protecting the nearest noise sensitive receptors. In this instance, the nearest noise sensitive receptors are those in the flats above Pizza Hut in flats, 1, 2 and 3 with residents overlooking the extract flue on the first and second floors.

It is understood that an acoustic report has already been submitted to the local planning authority (Ned Johnson Acoustic Consultants, dated 7th December 2017). As previously stated, the application of such a condition ultimately seeks to protect residential amenity and reduce the likelihood of any future complaints being received as a result of the plant/machinery being operated. Consultee comments by Environmental Health were made regarding the report (7.12.2017) with specific reference made to the impact of the fan being reported at both low and high speeds.

Since the planning application LU/56/17/PL, a new planning application was determined (LU/321/17/PL) on 14th Feb 2018 which included the more appropriate requirement of assessing the newly converted flats and internal soundscape against BS8233:2014 (Condition 4). The client had stressed that as part of the assessment, the internal noise measurements needed to consider the impact of the Pizza Hut extract/ductwork.

However, with the more appropriate requirement of considering internal room noise levels in close proximity to the Pizza Hut extract, it is argued that the sounds associated with the extract system and ductwork have been appropriately assessed using the nearest noise sensitive receptors, with a window open and with changes in the fan level recorded and documented above in 4.2. It is therefore argued that the BS4142:2014 assessment required by condition 3 of LU/56/17/PL is now redundant as a more appropriate analysis has been carried out and indicates that the extract system is not a problem.

5 Ventilation

There are a number of ways of ventilating and providing fresh air into a property. When considering ventilation, there must be sufficient air changes but also compliance with the building regulations (Approved Document F).

The options are as follows:

System 1 - Background ventilation using trickle vents

System 2 - Passive stack ventilation

System 3 - Continuous mechanical extraction ventilation (MEV)

System 4 - Mechanical Ventilation and Heat Recovery (MVHR)

Whilst residents retain the freedom to open their windows, by doing so, the internal noise levels will be exceeded. However, for purge ventilation, it is important to note that noise levels are not applicable. Purge ventilation is the process of allowing rapid turnover of air changes when for example one wishes to remove cooking odours or paint fumes from inside the property.

The client has agreed to fit a system 1 ventilation type which are acoustically attenuated trickle vents to the windows for the habitable rooms in flat 1 and in flats 2 and 3 facing Beach Road for the purposes of providing background ventilation. The trickle vents compliment the already existing fireplaces for flats 2 and 3.

The model selected is a Greenwood 5000EA model providing high levels of air flow and good acoustic performance of between 39 dB $D_{n,e,w}$ and 42 dB $D_{n,e,w}$. An illustrative image is seen in Figure 15 below. Ultimately, it will be the decision for the end tenant/resident as to whether the trickle vents are used. Introducing the high-performance acoustic trickle vents will have minimal performance on the current internal soundscape.



Figure 15. Greenwood Acoustically Attenuated Trickle Vent

6 Uncertainty

The sound level meters used were calibrated before and after the survey in situ, without any drift having occurred, to ensure that the information and data being obtained was representative and that the sound level meters were operating correctly.

The report also considered and measured rooms likely to be most impacted as a worst case, including those bedrooms closest to the Pizza Hut extract, as well as the bedroom closest to the road traffic at the first-floor level with a high ratio of glazing to the internal smaller room space.

As internal measurements, weather was not an influencing factor and did not need to be considered. Also, as real time internal measurements, there was no reliance on modelling, or corrections, the data obtained was representative of the conditions being experienced.

To ensure a robust process and to reflect the fact that the rooms were not in a finished state, reverberation times were recorded to be able to adjust the rooms for their likely absorption values once occupied.

To reduce uncertainty, attended measurements were also made to examine the impact of increased fan speeds to ensure that these were robustly covered within the reporting process.

7 Noise Mitigation Measures

To ensure adequate background ventilation for the habitable rooms, the client has agreed to fit high performance acoustically attenuated trickle vents to the existing window frames. The Greenwood 5000EA model is a top of the range attenuator.

8 Conclusion

Two class one sound level meters measured sound levels at three positions inside 22 Beach Road, Littlehampton, at the first-floor converted flats. Measurements were made in the bedroom in flat 1 to the rear (West) and two bedrooms in flat 2 (East), with microphones in rooms measuring both the rear bedroom closest to the Pizza Hut extract ductwork and the bedroom overlooking Beach Road and experiencing road traffic noise. The internal survey was undertaken from 10th May 2019 to 14th May 2019 over a busy weekend period to present a robust and worst-case reporting period.

As the rooms were not finished and largely reverberant, reverberation times were measured in the three bedrooms to calculate any corrections needed to represent furnished or lived in properties with greater absorption.

The results gathered indicated that the bedrooms measured to the rear of 22 Beach Road in close proximity to the Pizza Hut extract fan all met the daytime and night time requirements of BS8233:2014. In the case of the flat 2 bedroom, this met the standard with the window left cracked open.

The flat 2 bedroom overlooking Beach Road was noted to exceed the initial requirements of BS8233:2014 with the windows closed, however, when adjustments were made for absorption

and a 5dB(A) relaxation applied as advocated in BS8233:2014 (7.7.2), the requirements have been met for both daytime (relaxed standard) and night time (30dB $L_{Aeq,8\text{ hour}}$).

In view of the above testing conditions and the data presented, it is considered that the requirements of condition 4 have been met and may be discharged by the local planning authority. It is also considered that condition 3 of LU/56/17/PL is no longer applicable, as the Pizza Hut extraction system has been assessed against the nearest flats with windows open and with changes in fan speeds reported, without adverse impact to the residential amenity of the flats above 22 Beach Road.