Bickerdike
Allen
Partners
Architecture
Acoustics
Technology

KARMA BAKEHOUSE AND 1A MARYON MEWS NW3

ACOUSTIC ASSESSMENT

Report to

Stephen Isaacs
Karma Bakehouse
13 South End Road
London NW3 2PT

Gifford Laing
1A Maryon Mews
London NW3 2PU

A9899-R02-AH
17 September 2015

Bickerdike Allen Partners is an integrated practice of Architects, Acousticians, and Construction Technologists, celebrating over 50 years of continuous practice.

Architects: Design and project management services which cover all stages of design, from feasibility and planning through to construction on site and completion.

Acoustic Consultants: Expertise in planning and noise, the control of noise and vibration and the sound insulation and acoustic treatment of buildings.

Construction Technology Consultants: Expertise in building cladding, technical appraisals and defect investigation and provision of construction expert witness services.

Sustainability Consultants: Energy Conservation and Environmental Specialists and registered assessors for the Code for Sustainable Homes.

CDM Coordinators: Under UK CDM Regulations, a wholly owned subsidiary company Bickerdike Allen (CDM) Ltd.

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1.0 INTRODUCTION

Bickerdike Allen Partners (BAP) have been retained to provide acoustic consultancy services as a joint expert to the Karma Bakehouse 13 South End Road NW3 2PT, and the occupant of the adjoining property at 1a Maryon Mews NW3 2PU.

We understand that after a recent period of construction, the bakery, owned by Stephen Isaacs, has recently commenced operations and that the occupant of 1a Maryon Mews, Gifford Laing, is experiencing disturbance as a result of noise and vibration arising from machinery within the bakery, activities within the bakery in the early morning and use of a newly installed staircase within the bakery which lies adjacent to the party wall between the properties.

There has been extensive dialogue between the bakery, the bakery's architect and Gifford Laing discussing construction details of the bakery with respect to potential noise problems.

This report presents the results of an assessment of the transmission of noise and vibration between the bakery and 1a Maryon Mews. This report follows on from a scoping report issued following a site visit in July 2015[1].

This report has been prepared specifically in response to instructions received from Stephen Isaacs and Gifford Laing and is not intended for any other purpose.

2.0 THE SITE

2.1 Layout

Both properties are generally of brick construction. The bakery is located at 13 South End Road and opens out to the main road. 1a Maryon Mews is located in a mews behind South End Road. The dominant background noise sources in the mews are traffic noise and noise from plant to the rear of other businesses further north on South End Road.

The Karma Bakehouse is divided into a shop at the front and the bakery at the rear. Flats are located above the shop area. The bakery consists of a split-level ground floor with a mezzanine floor above in an extension to the original building. The ground floor is concrete with the two levels separated by concrete steps. Construction details of the concrete floor are not known.

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1. Bickerdike Allen Partners (2015). Karma Bakehouse and 1a Maryon Mews NW3, Acoustic Assessment, Scoping Report. A9899-R01-AH, 24 July 2015.

The bakery includes an office and staff toilet, reached by timber staircase, above the bakery on a mezzanine floor. This mezzanine floor is of timber construction.

The property at 1a Maryon Mews is a two-storey residence. There is an open-plan living room and kitchen downstairs with a bedroom upstairs. The floors are of timber construction and the walls are lined with plasterboard on dabs.

The party wall between the bakery and the residence is a brick wall supplemented by a stud wall on the bakery side. It is understood that this stud wall consists of a lining of two layers of 12.5 mm thick Soundbloc with the cavity filled with Rockwool. It is understood that although the cavity is 50 mm deep, there are areas where it is less than this. The stud wall is fixed at its head and base and it is understood that any connections between the stud wall and the brick wall have been broken. These has not been witnesses however.

It is understood that although the timber staircase to the mezzanine floor is not directly connected to the separating wall it is connected to a flanking wall which is rigidly connected to the brick part of the party wall.

The flanking construction consists of continuous brick walls on either side running between the properties.

Prior to its use as a bakery, the property at 13 South End Road was used as a clothes shop. It is understood that the shop was open Monday to Saturday during the daytime only with the back of house area used as a storeroom.

2.2 Bakery operation

The bakery operates 7 days a week. The bakery is open for business with the public between around 0730 and 1830 hours. Baking begins at 0500 hours and continues to 1400 hours.

The bakery has a number of internal pieces of machinery. These are:

- Two proofers.
- A bun divider.
- An oven.
- A mixer.
- A freezer.

Other than the proofers, these machines would only operate during baking hours i.e. from 0500 hours. The proofers may operate through the night. The baker uses hand whisk and steel bowls etc. during the early morning period.

The bakery is ventilated by a pair of fans of different sizes that vent to exhaust ducts on the roof. The larger of the fans is used to ventilate the ovens located between the back of house space and the shop with the smaller used to ventilate the back of house space. Each fan is located in its own cupboard in the office space and is bolted to a brick wall which is assumed to be the original rear wall of the building.

There are also two air conditioning units on the roof that serve the Bakehouse shop.

External noise levels from the air conditioning and vent exhausts at the nearest noise sensitive window have been assessed as part of a planning compliance report produced by KP Acoustics Ltd[2]. Predicted noise levels were in compliance with London Borough of Camden criterion for new noise emitting plant of 10 dB below lowest background level. No noise measurements have been undertaken by BAP to verify this performance.

It is understood the freezer is not currently in use and will be replaced by a domestic model.

There are steel cooling racks and trays and steel sinks and countertops in the bakery.

2.3 Disturbance to the occupant of 1a Maryon Mews

The occupant of 1a Maryon Mews, Gifford Laing, is experiencing disturbance as a result of the operation of the bakery. The nature of this disturbance is allegedly noise and vibration arising from machinery within the bakery, activities within the bakery in the early morning and use of a newly installed staircase within the bakery which lies adjacent to the party wall between the properties.

With respect to operation of machinery, a short duration, low frequency hum that occurs randomly during the day or night is reported by Gifford Laing. The operation of a vent in the bakery also results in a very loud disturbing noise in 1a Maryon Mews.

Gifford Laing has kept detailed logs recording instances of disturbance from noise and probable cause. These logs were taken during the construction and commissioning phase of the bakery and during normal operation of the bakery which has resulted in disturbing noise during the day and night.

Where possible, the bakery has ceased or altered noise generating activities in response to noise complaints. Examples of this are not using the vent and shifting of noisy baking activities to more sociable hours whenever feasible.

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2. KP Acoustics Ltd (2015). 13 South End Road, Hampstead, London Planning Compliance Report. Report 12822.PCR.01.

3.0 SITE VISITS AND TESTS

BAP made a number of visits to Karma Bakehouse and the adjoining property at 1a Maryon Mews as part of this assessment.

For the purposes of developing a scoping report[1], BAP visited site on the on 21 July 2015 and made some subjective, qualitative listening observations in both properties while various pieces of machinery within and on the roof of the bakery were in operation. Observations were made of general activities in the bakery and while people in the bakery were using the staircase. This visit included conversations with Stephen Isaacs, bakery staff and Gifford Laing to discuss the noise issues and to get an idea of the operation of the bakery.

The site was visited on the 17 and 18 August 2015 to carry out an airborne sound insulation test in between the bakery and the bedroom and living room in 1a Maryon Mews. Noise measurements were made in 1a Maryon Mews of the operation of the fans. Long term noise monitors were set up in both properties on the 17 August to run overnight. BAP visited site in the early morning of the 18 August to collect equipment and to observe bakery staff activities.

Long term noise monitors were also set up in both properties to take measurements between 3 September and 7 September 2015. On the 7 September, simultaneous vibration measurements were made in the bakery and 1a Maryon Mews of the back of house proofer during a 'loud' part of its operating cycle. Simultaneous vibration measurements were also taken while a vibration source (an electric motor) was run at various frequencies during this visit.

The airborne sound insulation tests were made using a Brüel and Kjær Type 2260 Investigator sound analyser with a JBL EON 10G2 Active Loudspeaker as a noise source.

Long-term noise measurements and attended noise and vibration measurements were made with a Norsonic 140 Sound Level Analyser. Brũel and Kjær type 4381 accelerometers were used for the vibration measurements.

In all cases sound level meters were calibrated before and after sets of measurements with no significant drift found.

4.0 ASSESSMENT

4.1 Subjective listening observations

During site visits, BAP listened in the living room and bedroom of 1a Maryon Mews to items of machinery in the bakery during their operation. These listening tests were carried out as systematically as possible with respect to the use of each item individually without interfering with the operation of the bakery and as advised what was in operation by the bakery staff.

In addition to these, observations were made of what could be heard in 1a Maryon Mews of the activities of bakery staff.

- Of the various items of machinery, the mixer and bun divider were very slightly perceptible above the daytime background noise. The proofer (it wasn't clear which one, or whether both were in operation during these tests) was more perceptible than the mixer and bun divider but this was still at a very low level compared to daytime background. As the proofer(s) may have been on, however, noise from it may have actually masked these other pieces of equipment.
- Although the oven and the air conditioning units were on during these measurements, when the air conditioning was turned off, no change in the background level was subjectively noticeable.
- Operation of the oven vent fan resulted in an unpleasant, audible noise in the residence.
- Operation of the back of house vent fan was not audible in the residence.
- General use of the kitchen by bakery staff was not audible.
- Use of uncarpeted stairs between the ground floor and mezzanine was noticeable. Although improved by use of carpet on the treads, their use was still audible.
- Banging on the counter tops in the back of house was audible. Banging on the sinks in the same location was audible in living room but not the bedroom. Stamping of feet on the floor of the back of house was audible in both living room and bedroom.

Observations were not made of the comparative noise levels from the vent fan rooftop exhausts as these were not considered to be problematic.

4.2 Airborne sound insulation tests

Airborne sound insulation tests were carried out between the bakery back house of house and office spaces and the living room and bedroom in 1a Maryon Mews.

These tests were undertaken in full accordance with BS EN ISO 140-4: 1998 *Field measurements of airborne sound insulation between rooms* and the procedures described in Annex B of Approved Document E (2003 Edition) to the Building Regulations 2010.

Results of these tests are given in Table 1.

Space		Airborne sound insulation performance $D_{nT,w} + C_{tr}$
From (Bakery)	To (1a Maryon Mews)	
Back of house	Living room	60
	Bedroom	56
Office	Living room	62
	Bedroom	56

Table 1: Maximum permissible background noise levels generated by building services installations

To put these results in some context, the minimum airborne sound insulation performance required by Approved Document E for a new-build separating wall is 45 dB $D_{nT,w} + C_{tr}$. For airborne tests, the higher the value, the better the sound insulation performance.

A sound insulation performance of 56 dB $D_{nT,w} + C_{tr}$ represents a considerable improvement above new build requirements. The corresponding $D_{nT,w}$ sound insulation performance between back of house and the bedroom is 63 dB. This value is 3 dB greater than the new build airborne sound insulation performance recommended between a hotel room and an adjacent commercial kitchen.

Based on these results, the level of an airborne noise source in the bakery would have to be very high to be observed in 1a Maryon Mews. Noise events with levels of this order of magnitude, however, were not observed from bakery activities (see Section 4.3).

Airborne sound insulation results sheets are given in the appendices.

4.3 Long term noise measurements

Two sets of long term measurements were made using sound level meters which were set up in both properties to attempt to identify the most likely cause of the randomly occurring, short duration, low frequency hum experienced by Gifford Laing.

As stated above, it was fairly certain from its hours of operation that this was due to a proofer and more likely that it was the one located in the back of house space due to proximity to 1a Maryon Mews.

Although the first set of measurements identified a number of events that were very likely to be the proofer, none of these events were identified by Gifford Laing as characteristic of the disturbing hum. It was understood that the proofer operated differently depending on ambient temperature, dough load etc. it was unclear which of these factors would result in the disturbing hum.

A number of disturbing events, however, were identified and logged by Gifford Laing during the second set of measurements. These are given in the appendices.

Each of these events were examined in detail both in terms of the A-weighted sound level and at individual 1/3 octave frequencies. Noise levels measured over on hour between 01:00 am and 02:00 am on the 6 September 2015 are shown in the figures below.

Figure 1 shows the A-weighted sound level measured in the bakery (red, upper) and 1a Maryon Mews (blue, lower).

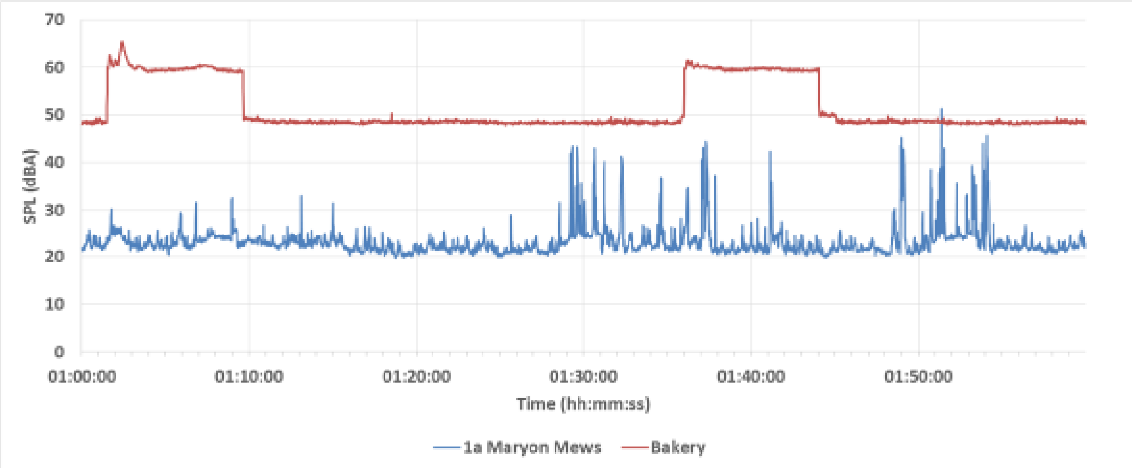


Figure 1: Long term noise measurment (extract), A-weighted sound pressure level

It can be seen from Figure 1 that there is a distinct increase in A-weighted sound level associated with the operation of the proofer (the first set of long term measurements include an attended observation of the proofer in the 'noisy', 5 to 6 minute part of its operation). There is, however, no accompanying increase in the A-weighted level in 1a Maryon Mews during these noisy events.

This is not the case when individual frequencies are considered. Figure 2 shows the sound level at 80 Hz for a person with normal hearing measured in the bakery (red, upper) and 1a Maryon Mews (blue, lower) and the threshold of hearing level at 80 Hz as given by ISO 226:2003 (black dashed).

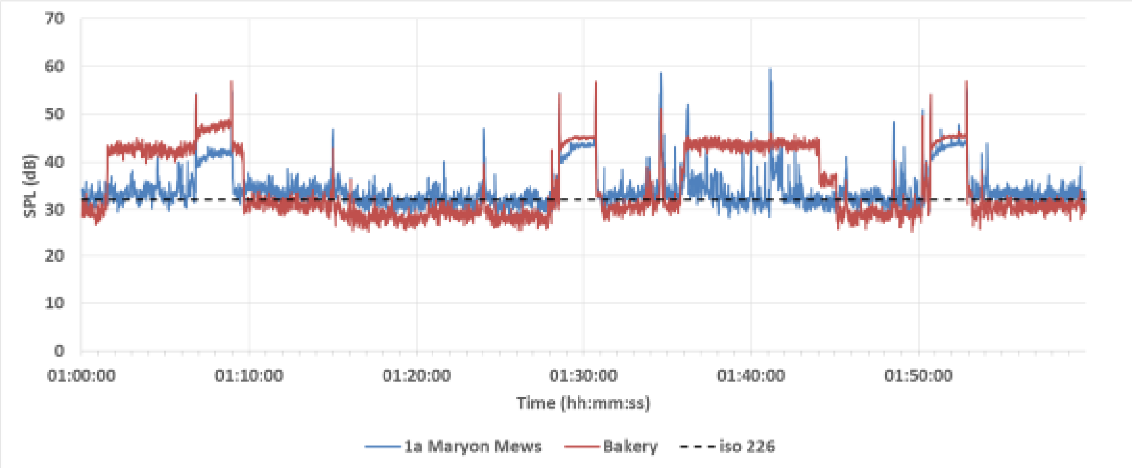


Figure 2: Long term noise measurment (extract), Sound pressure level at 80 Hz

From Figure 2 it can be seen that at this frequency a number of noise events that would be noticeable as they are 10 dB above the background level in 1a Maryon Mews can be identified at around 1:06 am, 1:28 am and 1:50 am. These times correspond to times logged for disturbance by Gifford Laing. They also match Gifford Laing's description of a low frequency disturbing noise that increases in loudness before abruptly cutting off.

From Figure 2 it can also be seen that the operation of the proofer at 80 Hz doesn't always result in a corresponding increase in level in 1a Maryon Mews. For the event that stars 01:01 am it can be seen that the noise from the proofer has reach a certain magnitude before it may become noticeable in 1a Maryon Mews. This is also shown at 01:36 am where the magnitude of the 80 Hz event is not sufficiently high to be noticeable in 1a Maryon Mews.

It can be seen by comparing the two figures that there isn't always a correspondence between the A-weighted events and the 80 Hz events. An example of this can be seen at around 01:30 am. This is due to the A-weighted background noise level in the bakery from proofer being dominated by contributions from higher frequencies.

In conclusion, measurements have been taken that correspond to Gifford Laing's observations. As the proofer is the only piece of equipment that operates at night, it is likely that these are due to regenerated noise caused by vibration from the proofer coupled with a possible resonance in the separating construction between the two buildings at 80 Hz, or a fundamental of 80 Hz.

4.4 Attended measurements

4.4.1 Vibration tests

Simultaneous vibration measurements were taken in both properties during operation of the proofer and with a motor mounted on a concrete block used to generate specific forcing frequencies between 25 Hz and 63 Hz in the bakery.

These found that there was a resonance in the floor of the back of house part of the bakery at 40 Hz. This corresponds to the findings discussed in Section 4.3 with respect to a resonance at 80 Hz which is a harmonic of 40 Hz.

4.4.2 Fan noise measurements

Measurements were taken in the bedroom of 1a Maryon Mews during operation of the oven fan and the back of house fan on a weekday evening. These were switched on with their speed setting left as found without adjustment. It is assumed that these speed settings correspond to normal fan operation in the bakery.

Spectral noise levels during fan operation and background noise levels without fan operation are shown in Figure 3.

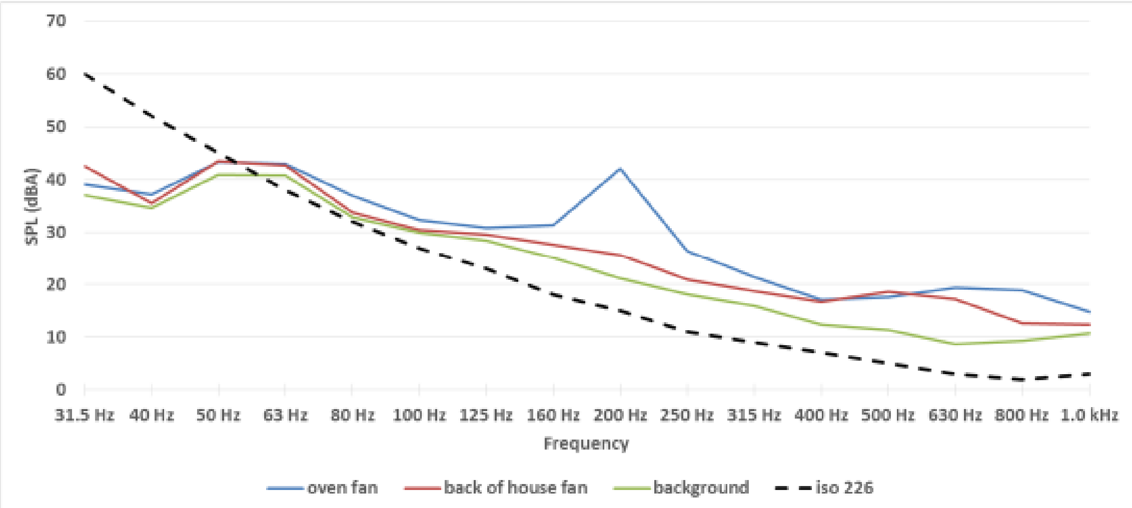


Figure 3: Fan noise levels

From figure 3 it can be seen that the back of house fan is close to the background level. This fan was considered to be inaudible during the measurement. The oven fan, however, has a distinct peak at 200 Hz which, although relatively low, would be audible. Audibility of this fan was observed during the measurement and has been raised as a disturbance by Gifford Laing in the past.

As the fan is located in a cupboard in the office and the airborne sound insulation performance between the office and 1a Maryon Mews is high, it is considered likely that vibration from the oven fan is being transmitted via the structure and re-radiated as noise.

5.0 RECOMMENDATIONS

Noise and vibration generated during activities in the bakery is transmitted to 1a Maryon Mews via the adjoining structure. This disturbing noise is compounded by the fact that a bakery can operate at relatively unsociable hours and replaces a clothes shop previously at 13 South End Road.

The bakery has demonstrated their willingness to address these matters and adopt practicable mitigation measures to reduce the likelihood of disturbance.

To reduce the likelihood of disturbance it is recommended that:

1. Use of all bakery equipment (excluding proofers) is limited to day time hours agreed between both parties. If possible, timer switches should be used to prevent accidental use outside these hours.
2. Bakery staff adopt best practice during unsociable hours to keep noise levels down. Although normal use of the kitchen is not disturbing, dropping heavy weights such as bags of flour on the floor would be.
3. The proofers are placed on a suitable resilient material with a resonant frequency less than or equal to 10 Hz. Details of the specialist manufacturers/distributors of anti-vibration products are:
    - CDM, Contact: Roger Kelly (Roger.kelly@cdm-uk.co.uk), Tel. 0166 448 2486
    - Farrat, Contact: Oliver Farrell (of@farrat.com), Tel. 0161 924 1600
    - TVS, Contact: James Shoebridge (JS@totalvibrationsolutions.com), Tel. 01706 260220
4. Rubber mats are used on metal shelves above counter and sinks. Rubber mats are also used in the sinks to reduce impact noise of pans etc. on the metal of the sinks.
5. The back of house counter is isolated from the flanking wall and located on resilient pads.
6. The oven fan is considered to not be adequately isolated from the structure of the building. It is directly bolted onto the original external wall of the bakery building which is, in turn, rigidly connected to 1a Maryon Mews. Also, it isn't clear whether the fan is

completely isolated from the duct work on either side of the fan with soft joints. It is recommended that the fan is isolated from the fabric of the building using hangers or similar in accordance with CIBSE recommendations. It is also recommended that it is isolated from ducting on either side using soft joints. The manufacturer should be contacted to ensure that at design speed, the ducting has been laid and sized such that noise regeneration due to elbows etc. or constrictions is prevented. The range of speeds operated by the fan should be investigated and taken into account in the design and selection of any anti-vibration control measures to be implemented.

7. Some beneficial reduction in noise transmission from the bakery staircase to 1a Maryon Mews could be achieved by lining the treads of the staircase with underlay and carpet. If the disturbance noise is not sufficiently abated by this measure, then it is recommended that the staircase is completely isolated from any wall that is rigidly connected to the separating wall.

As stated in the report above, noise from activities in the bakery are transmitted to 1a Maryon Mews via the structure, and in particular the floor which is rigidly connected to the flanking and separating walls.

If the recommendations listed above are not sufficient to prevent disturbance in 1a Maryon Mews it is recommended that rigid connection between the back of house concrete floor and surrounding walls is broken.

It is understood that the screed laid on the concrete sub-floor has been directly laid onto the concrete sub-floor but does not directly touch the brick party wall as the screed was laid after the party wall lining was installed. No opening up works, however, been undertaken to establish the detailed arrangement of screed, party wall lining construction and party wall.

Although it is not fully understood how the structural back of house concrete floor is built up, the level of noise transmission at particular frequencies implies that it is some kind of platform floor and it may be relatively straightforward to cut through the perimeter of the floor to create a 5 mm gap between the floor and walls which can then be loosely filled with mineral fibre and sealed with non-setting mastic.

6.0 SUMMARY

BAP have carried out an assessment of the transmission of noise and vibration between Karma Bakehouse 13 South End Road NW3 2PT, and the adjoining property at 1a Maryon Mews NW3 2PU.

Based on results on subjective listening tests, long term measurements and attended measurements, recommendations have been given to reduce the likelihood of activities and equipment in the bakery disturbing the occupant of 1a Maryon Mews.

Anthony Hayes
for Bickerdike Allen Partners

Peter Henson
Partner

APPENDIX 1

GLOSSARY OF ACOUSTIC TERMINOLOGY

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10^{-5} Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

Statistical Term	Description
$L_{Aeq, T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq, T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.
L_{A90}	The level exceeded for 90% of the time is normally used to describe background noise.
$L_{Amax,T}$	The maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast), or S (slow)

Sound Transmission in Rooms

Sound energy is reflected from the room surfaces and this gives rise to reverberation. At short distances from a sound source, the sound level will fall off at a rate of 6 dB per doubling of distance, as it would in the open air – this is known as the direct field. Beyond a certain distance, the effect of reverberation takes over and the level ceases to fall off significantly with distance from the source. This is known as the reverberant field. For receiver positions in this part of the room, sound levels can be reduced by applying sound absorbing finishes to the surfaces of the room. A 3 dB reduction can normally be obtained by doubling the absorption present, which corresponds to halving the reverberation time (see below).

Sound Insulation - Airborne

Voices, hi-fi systems, television and radio sound and musical instruments are all sources of airborne sound. They excite the air around them and the vibration in the air is transmitted to surrounding surfaces, such as walls, ceilings and floors. This sets these constructions into vibration and this vibration is radiated in neighbouring rooms as sound. Energy is lost in the transmission path and this is referred to as transmission loss or, more generally, sound insulation. The most simple measure of sound insulation is the sound level difference, D, which is the arithmetic difference between the sound level, in dB, in the source room and the sound level in the receiving room.

Other measures of sound insulation include the sound reduction index, R, which is a measure of the acoustical performance of a partition, obtained in a laboratory, and the standardised level difference, D_{nT}, which is used mainly in the sound insulation of domestic separating walls and separating floors. The relevant test procedures are laid down in BS EN ISO 140. A single figure "weighted" result can be obtained from one-third octave band test results by using a curve-fitting procedure laid down in BS EN ISO 717. The subscript "w" is added to the relevant descriptor (eg $D_{nT,w}$).

The sound reduction index, R, is used in the specification of components, such as partitions, doors and windows. It is important to bear in mind that the performance of components in the field is usually lower than can be obtained in a laboratory. The transmission of sound via other components common to both rooms ("flanking transmission") can reduce the apparent sound reduction index (R') significantly.

APPENDIX 2

AIRBORNE SOUND INSULATION TEST RESULTS

Bickerdike Allen Partners
Architecture Acoustics Technology

Standardized level difference according to ISO 140-4:1998

Field measurements of airborne sound insulation between rooms

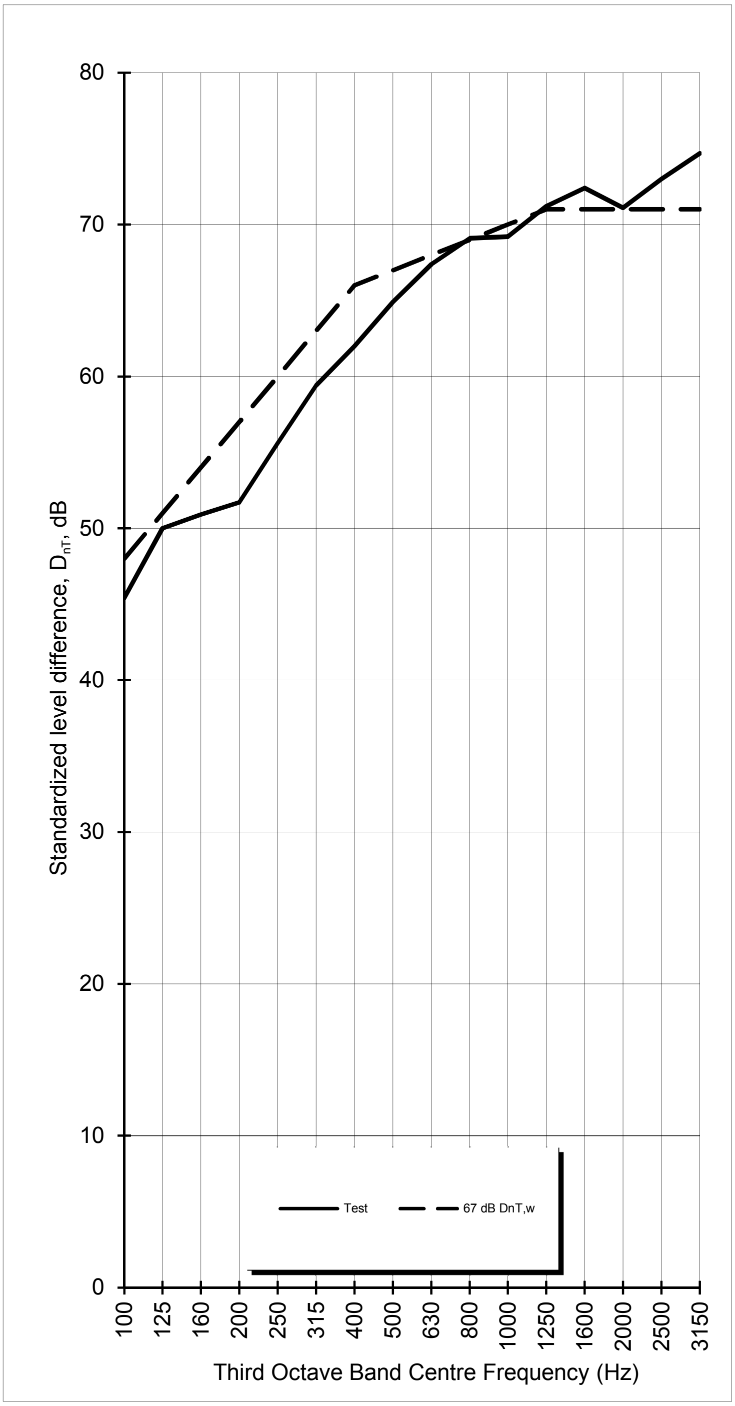
Job No:	A9899	**Test Date:**	17/08/2015	**Test:**	A
Job Title:	Karma Bakehse/1a Maryon Mws	**Tester:**	Tomasz Galikowski	**Partition:**	Wall
Client:	Isaacs/Laing	**Signature:**		**Source:**	Bakery back of house
				Receiver:	Maryon Mews living rm

ADE Type: 3

Description: ADE Type 3

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method

Frequency (Hz)	Test A D_{nT} (dB)	Adverse Deviation (dB)	Rec. RT (s)
50	**≥ 40.5**		0.51
63	**≥ 46.6**		0.44
80	43.8		0.40
100	45.4	2.6	0.44
125	50.0	1.0	0.43
160	50.9	3.1	0.38
200	51.7	5.3	0.34
250	55.6	4.4	0.47
315	59.4	3.6	0.53
400	62.0	4.0	0.52
500	64.9	2.1	0.56
630	67.4	0.6	0.65
800	69.1		0.61
1000	69.2	0.8	0.53
1250	71.2		0.60
1600	72.4		0.53
2000	71.1		0.51
2500	73.0		0.53
3150	74.7		0.56
	Sum:	27.5	



Bold results indicate limits of measurement.

Underlined frequencies indicate that there is a difference > 6 dB between avg. source levels in those adjacent ⅓ octave bands.

Results for frequencies below 100 Hz, where given, are for information only.

$D_{nT,w}$	67 dB
$C_{tr,100-3150}$	-7 dB
$D_{nT,w} + C_{tr,100-3150}$	**60 dB**

Area of Test Partition:	10 m²
Source Room Volume:	63 m³
Receiving Room Volume:	48 m³

Bickerdike Allen Partners
Architecture Acoustics Technology

Standardized level difference according to ISO 140-4:1998

Field measurements of airborne sound insulation between rooms

Job No:	A9899	**Test Date:**	17/08/2015	**Test:**	B
Job Title:	Karma Bakehse/1a Maryon Mws	**Tester:**	Tomasz Galikowski	**Partition:**	Wall
Client:	Isaacs/Laing	**Signature:**		**Source:**	Bakery back of house
				Receiver:	Maryon Mews bedrm

ADE Type: 3

Description: ADE Type 3

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method

Frequency (Hz)	Test B D_{nT} (dB)	Adverse Deviation (dB)	Rec. RT (s)
50	**≥ 33.9**		0.32
63	**≥ 39.5**		0.44
80	40.6		0.33
100	43.8	0.2	0.35
125	42.9	4.1	0.23
160	43.6	6.4	0.15
200	47.1	5.9	0.28
250	49.8	6.2	0.29
315	56.4	2.6	0.40
400	59.4	2.6	0.43
500	64.6		0.41
630	67.1		0.42
800	71.3		0.49
1000	72.1		0.50
1250	74.2		0.48
1600	**≥ 76.1**		0.49
2000	**≥ 77.8**		0.43
2500	**≥ 80.1**		0.41
3150	**≥ 78.6**		0.46
	Sum:	28.0	

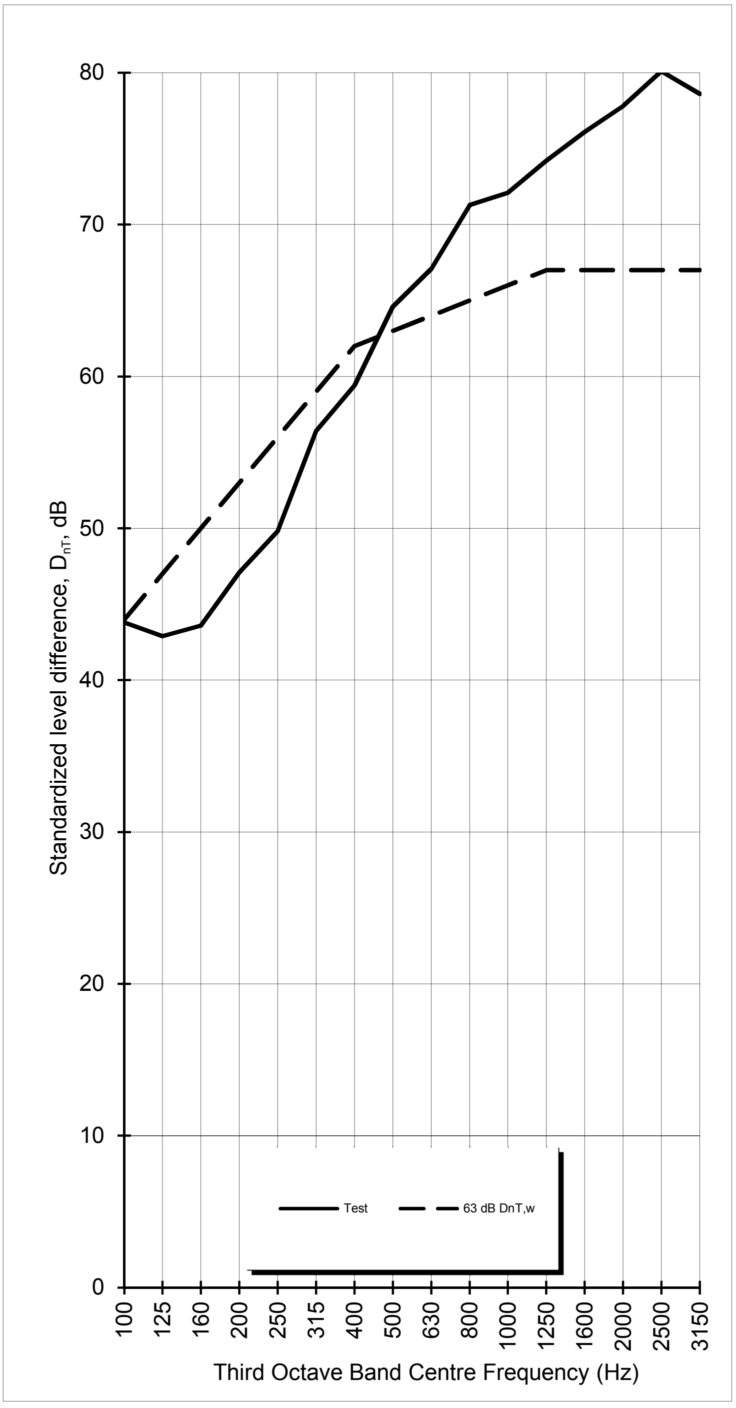
Bold results indicate limits of measurement.

Underlined frequencies indicate that there is a difference > 6 dB between avg. source levels in those adjacent ⅓ octave bands.

Results for frequencies below 100 Hz, where given, are for information only.

$D_{nT,w}$	63 dB
$C_{tr,100-3150}$	-7 dB
$D_{nT,w} + C_{tr,100-3150}$	**56 dB**

Area of Test Partition:	7 m²
Source Room Volume:	63 m³
Receiving Room Volume:	24 m³



Standardized level difference according to ISO 140-4:1998

Field measurements of airborne sound insulation between rooms

Job No:	A9899	**Test Date:**	17/08/2015	**Test:**	C
Job Title:	Karma Bakehse/1a Maryon Mws	**Tester:**	Tomasz Galikowski	**Partition:**	Wall
Client:	Isaacs/Laing	**Signature:**		**Source:**	Bakeryoffice
				Receiver:	Maryon Mews bedrm

ADE Type: 3

Description: ADE Type 3

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method

Frequency (Hz)	Test C D_{nT} (dB)	Adverse Deviation (dB)	Rec. RT (s)
50	**≥ 35.7**		0.32
63	44.4		0.44
80	43.1		0.33
100	44.7		0.35
125	43.2	3.8	0.23
160	44.3	5.7	0.15
200	48.2	4.8	0.28
250	49.5	6.5	0.29
315	56.2	2.8	0.40
400	56.7	5.3	0.43
500	63.9		0.41
630	67.9		0.42
800	**≥ 71.6**		0.49
1000	**≥ 72.4**		0.50
1250	**≥ 72.7**		0.48
1600	**≥ 72.7**		0.49
2000	**≥ 73.8**		0.43
2500	**≥ 75.1**		0.41
3150	**≥ 78.2**		0.46
	Sum:	28.9	

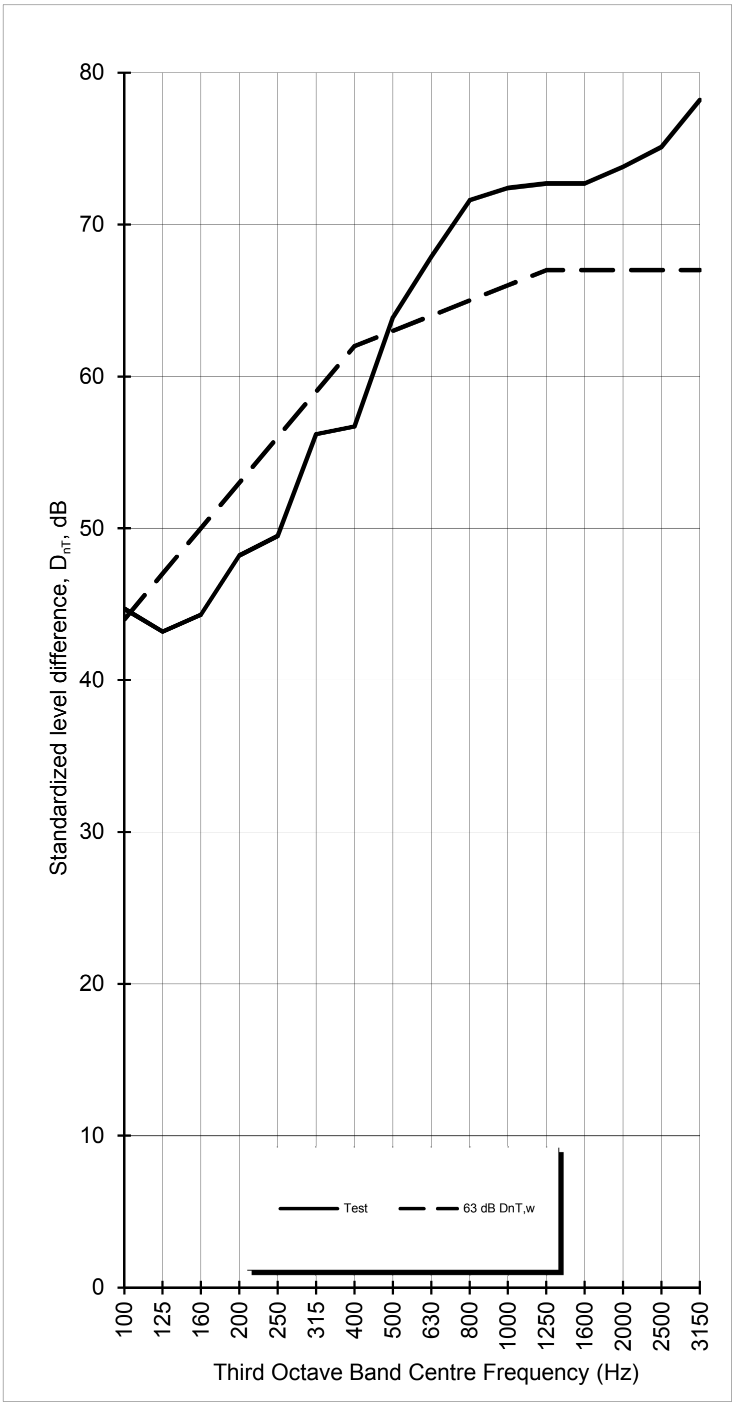
Bold results indicate limits of measurement.

Underlined frequencies indicate that there is a difference > 6 dB between avg. source levels in those adjacent ⅓ octave bands.

Results for frequencies below 100 Hz, where given, are for information only.

$D_{nT,w}$	63 dB
$C_{tr,100-3150}$	-7 dB
$D_{nT,w} + C_{tr,100-3150}$	**56 dB**

Area of Test Partition:	0 m²
Source Room Volume:	61 m³
Receiving Room Volume:	24 m³



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Standardized level difference according to ISO 140-4:1998

Field measurements of airborne sound insulation between rooms

Job No: A9899
Job Title: Karma Bakehse/1a Maryon Mws
Client: Isaacs/Laing

Test Date: 17/08/2015
Tester: Tomasz Galikowski
Signature:

Test: D
Partition: Wall
Source: Bakeryoffice
Receiver: Maryon Mews living rm

ADE Type: 3
Description: ADE Type 3

Evaluation based on field measurement results obtained in one-third octave bands by an engineering method

Frequency (Hz)	Test D D_{nT} (dB)	Adverse Deviation (dB)	Rec. RT (s)
50	**≥ 37.9**		0.51
63	46.6		0.44
80	48.2		0.40
100	48.9	0.1	0.44
125	50.0	2.0	0.43
160	50.2	4.8	0.38
200	52.3	5.7	0.34
250	55.8	5.2	0.47
315	60.4	3.6	0.53
400	63.8	3.2	0.52
500	68.3		0.56
630	**≥ 75.0**		0.65
800	**≥ 75.9**		0.61
1000	**≥ 76.7**		0.53
1250	**≥ 79.0**		0.60
1600	**≥ 79.7**		0.53
2000	**≥ 80.5**		0.51
2500	**≥ 82.3**		0.53
3150	**≥ 83.5**		0.56
	Sum:	24.6	

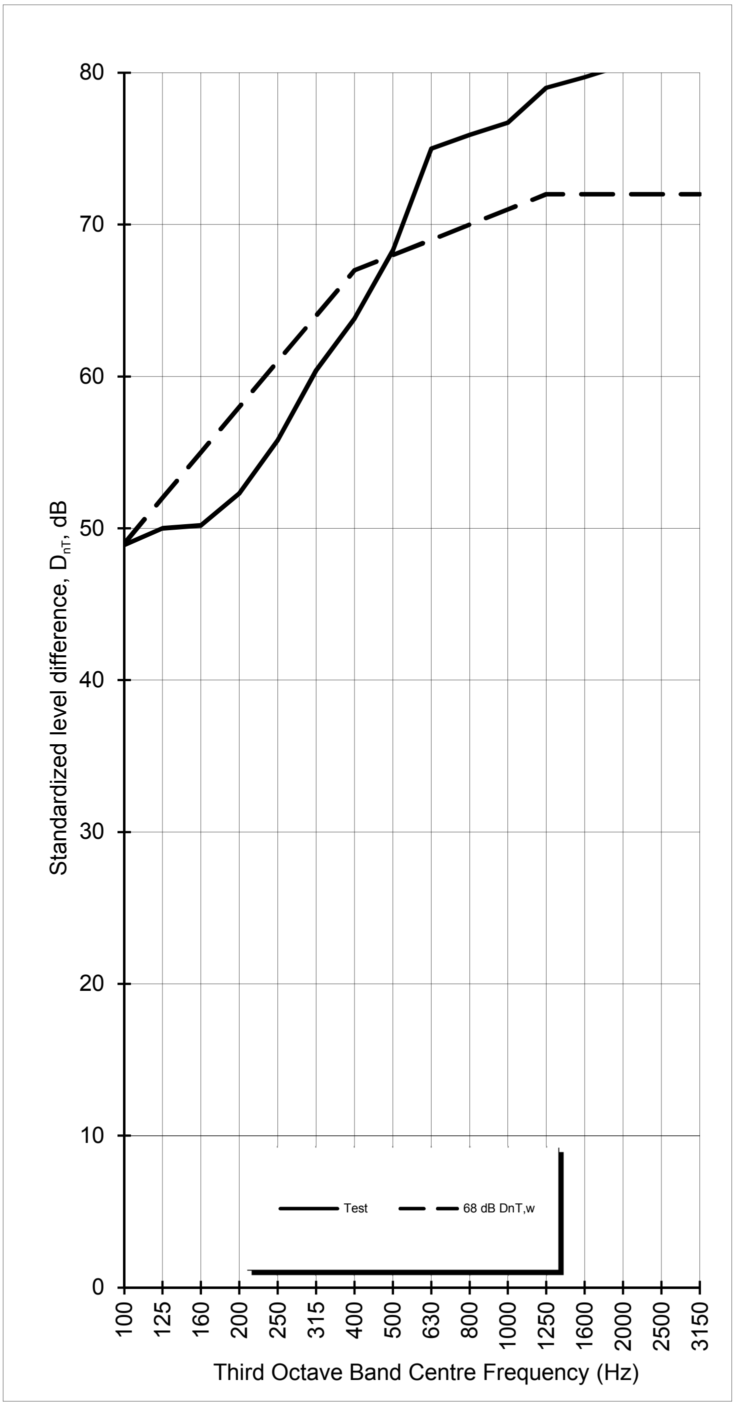
Bold results indicate limits of measurement.

Underlined frequencies indicate that there is a difference > 6 dB between avg. source levels in those adjacent ⅓ octave bands.

Results for frequencies below 100 Hz, where given, are for information only.

$D_{nT,w}$	68 dB
$C_{tr,100-3150}$	-6 dB
$D_{nT,w} + C_{tr,100-3150}$	**62 dB**

Area of Test Partition:	0 m²
Source Room Volume:	61 m³
Receiving Room Volume:	48 m³



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APPENDIX 3

GIFFORD LAING'S DISTURBANCE LOGS

Noise Diary of disturbances at 1A Maryon Mews

Gifford Laing

26 July 2015

08/07/15 23:20	Intermittent banging noise and a small machine that makes short bursts of sound like an electric blender.
09/07/15 00:53	Woken by banging noise.
09/07/15 05:15	Woken again by banging noises which then continue intermittently for about 15 minutes.
09/07/15 08:15	Disturbed by bakery staircase noise that continues loudly every few minutes for 15 mins, then more intermittent.
09/07/15 14:50	New hum and vibration from unknown equipment (later discovered to be “oven ventilation”); runs continuously; some of my walls vibrate; very disturbing; continues at least until at least 20:45.
09/07/15 23:10	New hum has stopped.
09/07/15 23:30	New hum restarts; same disturbing loudness and vibration; feel it will be impossible to sleep; a friend is visiting and is astounded by the noise and says she would not tolerate this in her own home.
09/07/15 23:50	I complain to bakery, who trace hum to oven ventilation; they switch it off so I can sleep.
10/07/15 02:00	Woken by someone moving around.
10/07/15 02:21	Woken again by someone moving and banging; bursts of machinery noise like electric blender until about 02:45.
10/07/15 06:35	Woken by banging.
10/07/15 06:49	Hum starts again whilst I am trying to get back to sleep.
10/07/15 06:54	Hum stops.
10/07/15 06:59	Hum restarts.
10/07/15 07:05	Hum faded out quickly and stopped.
10/07/15 07:30	Thumping noise; I get up and am tired after broken sleep.
10/07/15 13:05	Loud and constant hum clearly audible whilst sitting at my living room table.
10/07/15 13:50	Hum stops; I realise that the constant noise has been making me tense.
10/07/15 14:26	Oven ventilation noise starts, speeds up, low frequency pulsing, unpleasant vibration, distracting and difficult to concentrate; daytime ambient noise makes it seem slightly quieter than at night, but still disturbing.
10/07/15 16:20	Oven ventilation noise is ongoing; the pulsing seems louder than before, it's very intrusive.
10/07/15 16:45	Loud bangs intermittently for about 5 mins that shake my living room; equipment or furniture being dragged around – probably builders?
10/07/15 16:54	Oven ventilation noise getting really oppressive, and making me feel irritable and ill.
10/07/15 17:04	Builders drilling.
10/07/15 18:50	Oppressive oven ventilation noise ongoing.

10/07/15 19:10	Oven ventilation noise is ongoing; I leave the house.
10/07/15 22:35	Oven ventilation noise has stopped but another hum continues in living room and bedroom; it spoils the peace and quiet that I am used to at this time of night; worried about being not able to sleep.
10/07/15 23:30	Go to bed; the noise fills the room and it is very hard to get to sleep.
11/07/15 07:04	Hum stops after a very disturbed and mostly sleepless night during which I tried sleeping on the sofa downstairs for a while but it was no quieter, and then moved upstairs again.
11/07/15 11:30	Hum audible again, though there is more ambient noise to cover it in the daytime; still too intrusive in my living room.
11/07/15 22:30	All machines are off; my home seems back to normal and I sleep normally.
12/07/15 07:30	Footsteps while I am dozing; within normal/acceptable levels.
12/07/15 11:00	Hum resumes continuously; unpleasant low frequency pulsing while I am at my desk, makes it hard to concentrate.
12/07/15 13:55	Hum ongoing.
12/07/15 15:39	Hum really oppressive; impossible to enjoy a quiet afternoon at home.
12/07/15 17:44	Hum very loud; my staircase starts vibrating; this lasts for a few seconds and then the machine cuts out and the hum stops.
13/07/15 08:13	Very loud hum audible in every room of my house; after a few minutes the hum gains extra overtones and gets even louder; switches on and off momentarily, then back on again for several minutes.
13/07/15 08:30	Hum reduces, then switches off.
13/07/15 08:41	Loud hum starts, then switches on and off every 30 seconds for a few minutes; I feel the hum's bass frequency in my stomach which is unpleasant.
13/07/15 08:44	Loud hum continuous.
13/07/15 08:51	Loud hum stops for a moment and restarts, then runs continuously.
13/07/15 10:34	Loud hum stops.
13/07/15 11:35	Loud hum starts.
13/07/15 12:27	Hum gets even louder; vibration in parts of my house; my staircase is vibrating strongly.
13/07/15 15:25	Hum stops.
14/07/15	Relieved that there is little activity in bakery and no oven ventilation hum today.
14/07/15	New constant noise, like a noisy fridge, audible 24 hours a day.
14/07/15 23:30	People walking on bakery staircase every 5 mins until 23:50 while I am trying to sleep.
14/07/15 23:30	Low-frequency rumble (I later discover to be “retarder/prover” machine) that slowly gets louder and changes tone, then stops, then the cycle begins again; continues until at least 01:30 whilst I am trying to sleep.
15/07/15 00:35	Woken by people walking on bakery staircase.
15/07/15 00:55	Woken again by people walking on bakery staircase.
15/07/15 08:15	Loud hum starts and is audible in every room of house; intermittently switches on and off until 09:15.
16/07/15 07:00	Spent previous night sleeping on floor of home office, because unable to risk broken sleep in bedroom; went to bedroom in morning but retarder low-frequency rumbling is audible.

16/07/15 22:49	Unable to sleep in bedroom due to low-frequency rumble of retarder (same as 14 and 16 July); very stressed by lack of sleep and oppressive noise; reluctantly go to sleep on floor of home office again.
17/07/15 00:30	Double-checked bedroom before going to sleep but noise of retarder is still audible.
18/07/15 18:45	Low-frequency noise of retarder is audible in my bedroom and living room.
18/07/15 23:21	Reluctantly go to sleep on floor of home office again to avoid stress of being woken during the night in bedroom.
18/07/15 23:21	I went to stay with friends to avoid disturbances from bakery.
21/07/15 22:00	Retarder running; a neighbour comes to listen and compares noise to “being on a ferry”.
21/07/15 23:15	(approx time) Retarder quiet.
22/07/15 01:07	Woken by retarder.
22/07/15 05:43	Woken again by retarder in louder part of its cycle.
22/07/15 06:20	Woken by retarder.
22/07/15 06:29	Retarder in louder part of its cycle.
22/07/15 06:40	Retarder quiet.
22/07/15 10:05	Loud hum starts; switches on/off for several minutes, then remains on.
22/07/15 10:16	Additional hum (higher tone) switches on/off, then remains on with the first (low) hum for a minute.
22/07/15 10:18	Hum starts to pulse and get louder; then stops after about 4 minutes.
22/07/15 10:28	Hum restarts, with a pulsing that takes a few seconds to speed up.
22/07/15 11:01	Loud hum and vibration in South wall (oven ventilation?); lasts approximately 4 hours; a neighbour comes to listen at 13:20 and says “no-one should have to live with that”.
22/07/15 19:00	(approx time) Retarder is running.
22/07/15 19:59	Retarder goes quiet.
23/07/15 05:35	Woken by someone doing things in bakery.
23/07/15 05:40	Machine starts (dough mixer?).
23/07/15 05:43	Went to home office to sleep on floor.
23/07/15 07:55	Retarder in louder part of its cycle.
23/07/15 19:00	Retarder is running.

26/07/15 05:14	Woken by someone doing things in bakery.
26/07/15 05:23	Woken again by someone doing things in bakery.
26/07/15 05:45	Woken again by someone banging things in bakery.
26/07/15 06:13	Woken by fast repeated banging – chopping?
26/07/15 06:30	Woken by intermittent knocking which lasts for about 10 minutes.
26/07/15 06:42	Sound of large item being moved/dragged across floor while I am dozing.
26/07/15 06:55	Retarder starts, then gets louder and runs for about 2 hours.

Notes of Acoustic monitoring at 1a Maryon Mews
3 September to 7 September 2015
Gifford Laing

General notes:

- All notes made in bedroom unless otherwise stated.
- All noise events in bedroom woke me from sleep, unless events were just a few minutes apart.
- All retarder-prover noise in bedroom was heard/felt through bed-frame; the louder the noise, the more audible it also became in the room/through the air.

Switch pushed	Date/Time	Heard
	03/09/2015 20:10	Retarder-prover starts to become audible for the first time in several days; heard in living room.
Yes	04/09/2015 06:13	Retarder-prover cycling in tone; quiet to medium loudness.
Yes	04/09/2015 06:20	Retarder-prover low-frequency hum; quieter.
Yes	04/09/2015 06:24	Retarder-prover cycling in loudness; quieter.
Yes	04/09/2015 06:28	Retarder-prover cycling in loudness; quieter.
	04/09/2015 07:45	Retarder-prover low-frequency hum; cycling in loudness; quiet to medium.
	04/09/2015 08:14	Retarder-prover low-frequency hum; cycling in loudness; heard in bedroom and living room; quieter.
	04/09/2015 11:14	Retarder-prover cycling in tone; heard in living room; quiet to medium.
	05/09/2015	Retarder-prover not heard in bedroom or living room all day/night.
	06/09/2015 00:20	Retarder-prover low-frequency hum; quieter.
Yes	06/09/2015 01:29	Retarder-prover low-frequency hum; much quieter.
Yes	06/09/2015 01:30	Retarder-prover descending in tone while getting louder.
	06/09/2015 01:50	Retarder-prover low-frequency hum; much quieter.
Yes	06/09/2015 01:52	Retarder-prover descending in tone while getting louder.
	06/09/2015 02:38	Retarder-prover descending in tone while getting louder.
	06/09/2015 03:03	Retarder-prover low-frequency hum.
	06/09/2015 03:05	Retarder-prover descending in tone while getting louder.
Yes	**06/09/2015 03:33**	**Retarder-prover loud.**
Yes	06/09/2015 03:37	Retarder-prover loud noise stops abruptly.
	06/09/2015 03:??	(exact time not recorded) Retarder-prover low-frequency hum; quieter.
	06/09/2015 03:55	Retarder-prover descending in tone while getting louder.
	06/09/2015 04:10	Retarder-prover low-frequency hum; quieter.

Yes (too late)	06/09/2015 04:12	Retarder-prover descending in tone while getting louder.
	06/09/2015 05:2?	Retarder-prover low-frequency hum.
	06/09/2015 05:25	Retarder-prover descending in tone while getting louder.
	06/09/2015 23:55	Retarder-prover low-frequency hum; quieter.
	07/09/2015 01:01	Retarder-prover descending in tone while getting louder.
	07/09/2015 01:2?	(exact time not recorded) Retarder-prover low-frequency hum; quieter.
Yes	07/09/2015 01:??	(exact time not recorded) Retarder-prover descending in tone while getting louder.
	07/09/2015 01:49	(exact time not recorded) Retarder-prover low-frequency hum; quieter.
Yes	07/09/2015 01:50	Retarder-prover descending in tone while getting louder.
	07/09/2015 02:47	Retarder-prover low-frequency hum; quieter.
Yes	07/09/2015 02:48	Retarder-prover descending in tone while getting louder.