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3-5 RED LION STREET, RICHMOND

NOISE IMPACT ASSESSMENT

Report **8636-NIA-01**

Prepared on 8 November 2013

Issued For:

Arthur Murray Dance Studios Ltd

77 Baker Street

London

W1U 6RF

committed to CSCS Platinum award

ISO 17025

ISO 9001

Institute of Acoustics sponsoring organisation

Contents

List of Attachments

1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Arthur Murray Dance Studios Ltd to assess the noise impact from the proposed dance studio facility at 3-5 Red Lion Street, Richmond, TW9 1RJ on nearby residential properties.

This report presents the results of a background noise survey undertaken to establish existing conditions, a noise break out assessment and sound insulation investigation followed by an assessment of predicted dance studio noise emissions and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

The proposed dance studio is located on the first floor of a commercial building at 3-5 Red Lion Street. The ground floor is currently a hairdressing salon and the area is a mixed commercial and residential area. The site is bounded by commercial premises to the north and west, Lion House to the east and Red Lion Street to the south.

The closest residential receivers are understood to be on the upper floors of Lion House, opposite the east facade of 3-5 Red Lion Street at a distance of approximately 4 metres as shown in indicative site plan 8638-SP1.

The closest commercial receiver is the ground floor hairdressing salon at 3-5 Red Lion Street.

3.0 PROCEDURE

3.1 Environmental Noise Survey

In order to measure existing background noise levels at the site, an environmental noise survey was undertaken over a weekend period at the position marked on indicative site plan 8636-SP1.

Continuous automated monitoring was undertaken for the duration of the survey between 15:00 on 18 October and 05:00 on 22 September 2013.

The measurement procedure generally complied with BS7445:1991. *Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*.

Measurements of noise levels were undertaken at the south of the site and would therefore be expected to be representative of the background noise levels experienced at the nearest noise sensitive receiver location.

3.2 Noise Breakout Measurements

High volume "white" noise was generated from two loudspeakers in the first floor of the building, positioned to obtain a diffuse sound field. A spatial average of the resulting one-third octave band noise levels between 50 Hz and 20 kHz was obtained by using a moving microphone technique over a minimum period of 15 seconds at each of two positions.

The same measurement procedure was used inside and outside the building in order to depict the best possible impression of noise break-out at identified potential breakout points (shown in indicative site plan 8636-SP1). The duration of outdoor measurements ranged from 30-90 seconds, depending on the background noise pattern. External receiver measurements were taken at the east facade in order to assess the main breakout path to nearby identified noise sensitive receivers.

The background noise levels at the external measurement positions were measured during the tests and the receiver levels corrected accordingly.

The dominant source of background noise observed during the tests was road traffic noise from surrounding roads.

3.3 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 2 No. Svantek Type 957 Class 1 Sound Level Meter (for external noise survey)
- Norsonic Type 1251 Class 1 Calibrator

The instrumentation used during noise breakout measurements is shown in Table 3.1 below.

nstrument	Manufacturer and Type	Serial Number
Precision integrating sound level meter & analyser	01dB-Stell Grey Solo	10045
Active Loudspeaker	RCF ART 310A	HAX20870
Active Loudspeaker	RCF ART 310A	GEX05725
White Noise Source	Acoustic Solutions – 513/4043	N/A
White Noise Source	Acoustic Solutions – 513/4043	N/A
Calibrator	Norsonic Type 1251	31716
Specialist Software	01dB-Metravib dBBati	V5.050

Table 3.1 Instrumentation used during breakout measurements

4.0 RESULTS

4.1 Environmental Noise Time History

The $L_{Aeq:\ 5min}$, $L_{Amax:\ 5min}$, $L_{A10:\ 5min}$ and $L_{A90:\ 5min}$ acoustic parameters were measured during the course of the survey and are shown as a time history in Figure 8636-TH1.

Background noise levels were dominated by road traffic noise from surrounding roads. Minimum measured background levels are shown in Table 4.1.

	Minimum background noise level $L_{A90\ :\ 5min}$ dB(A)
Daytime (07:00 – 23:00)	47
Night-time (23:00 – 07:00)	35
Friday Operational Hours (15:00-23:00)	55
Saturday Operational Hours (11:00-22:00)	53
Sunday Operational Hours (11:00-22:00)	51
Monday Operational Hours (11:00-23:00)	50

Table 4.1: Minimum measured background noise levels

4.2 Noise Breakout Levels

Summarised results of the airborne tests are shown in Table 4.2. The main parameter used to express airborne sound insulation of separating constructions is D_w. It should be noted that there is a difference of about 5-8 dB between the laboratory sound insulation R_w value and the D_w measured on site, with the latter being lower as it is dependent on various parameters such as flanking. All measurements locations are shown on indicative site plan 8636-SP1.

Test Location	Source	Element	Test Result
Location 1 *[External]*	First Floor Space	Secondary Glazing	D_w 36dB
Location 2 *[Internal]*		Separating Floor	D_w 33dB

Table 4.2 Breakout Measurement Results

5.0 NOISE EMISSIONS CRITERIA

In order to assess the likely impact of the proposed dance studio on nearby residents, we would suggest the comparison of anticipated noise emissions levels to the minimum measured background noise levels (L_{A90}) and provide a rating of impact according to BS4142:1997:*'Method for rating industrial noise affecting mixed residential and industrial areas'*.

Although primarily used for assessing noise emissions of industrial activities, British Standard 4142:1997 can be seen as a good guide for assessing the suitability of noise emissions to residential receivers. In a BS4142 assessment, corrections are applied to measured noise levels in order to calculate a noise rating level for the effects of the source on nearby noise sensitive receivers.

As shown in Table 4.1, dance studio activities will only take place during the operating hours. This assessment will therefore compare noise emissions to the minimum measured background noise level during these times of 50dB(A).

In a BS4142 assessment, corrections are applied to measured noise levels in order to calculate a noise rating level for the effects of the source on nearby noise sensitive receivers. BS4142 states that a noise rating 5dB above the background noise level is of 'marginal significance'. If the difference is of 10dB or more, then there is an indication that 'complaints are likely'. A noise rating level of 10dB below the existing background noise is defined as 'a positive indication that complaints are unlikely'.

For noise breakout calculations, it has been deemed appropriate to refer to BS8233:1999 "*Sound insulation and noise reduction for buildings*". BS8233 describes recommended good to reasonable internal noise levels for various commercial spaces. Although not specific to a hairdressing salon, it is proposed to use the criterion for library, cellular offices and museums.

We would therefore recommend setting an internal noise criteria range of 40-50 dB(A) within the hair salon.

6.0 DISCUSSION

It is understood that the main noise source to assess is the breakout level of low level amplified music.

In order to calculate the breakout of anticipated noise emission levels, it is proposed to use a typical music spectrum with an overall level of 80dB(A), such that music is at a reasonable level.

Source noise levels used in calculations are as shown in Table 6.1.

	Sound Pressure Level (dB), in each Frequency Band, at source								
Source Noise	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Amplified music	73	76	77	79	75	72	68	71	80

Table 6.1: Source noise data used in caluclations

6.1 External Receivers

The main transmission path to the nearest noise sensitive receivers would be through the east facade of the first floor premises. The nearest noise sensitive receiver to this facade is the side of the residential property at Lion House, approximately 4 metres away as shown on indicative site plan 8636-SP1.

The following assessment has been made based on the results of measured noise breakout for the secondary glazed windows of the first floor and known masonry sound reduction indices.

Taking into account all necessary acoustic corrections, noise emissions levels at the residential receiver due to proposed activities would be as shown in Table 6.2. Detailed spectral calculations are shown in Appendix B1.

Receiver	Minimum Operating Hours Background Noise Level L_{A90}	Noise Level at Receiver (due to proposed activity)
Residential Receiver	50 dB(A)	32 dB(A)

Table 6.2 Noise levels and criteria at residential receivers

In a BS4142 Assessment, corrections are applied to noise sources for tonal content. In this instance, since the noise source is music, a 5dB penalty has been applied in the calculations to account for the inherent tonal content.

As shown in Table 6.2 and Appendix B, transmission of noise to the nearest sensitive window due to the effects of the worship activities would provide a noise rating level of -18dB when compared to the minimum background noise level. This would indicate that dance studio noise emission levels would indicate 'complaints being unlikely' in accordance with BS4142.

Noise emission levels would therefore not be expected to cause undue disturbance to nearby external residential receivers, without the need for any particular mitigation measures.

6.2 Internal Receivers

In order to predict the transmission of noise to the ground floor commercial space, calculations have been undertaken using the following standard acoustic formula:

$$SPL_{receiver} = SPL_{source} - SRI_{separation} + 10\log_{10} S - 10\log_{10} A$$

Where:

- $SRI_{seperation}$ is the calculated sound reduction of the floor [*Table 5.2*],
- S is the area of the transmitting floor [*approximately 140m^2*],
- and A is the absorption area of the receiving room [*400m^2 x 0.75 absorption coefficient*].

Taking all above factors into account, the predicted transmission level of noise to commercial spaces would be as shown in Table 6.3. Detailed spectral calculations are shown in Appendix B2.

Receiver	Design Range	Noise Level at Receiver [*due to proposed commercial activity*]
Ground Floor Commercial Space	40-50 dB(A)	44 dB(A)

Table 6.3: Noise levels and criteria at noise sensitive receiver

As shown in Table 6.3 and Appendix B2, noise transmission to commercial spaces would be expected to comply with the recommendations of the relevant British Standard, without the need for any particular mitigation measures.

In order to control noise emissions, we would recommend the installation of a noise limiter within the main dance studio space to ensure that receiver noise levels are compliant with the predicted noise levels.

The noise limiter should be set to a maximum level of 80 dB(A) and compliant with the frequency limits detailed in Table 6.1 above.

Although the airborne sound insulation is deemed sufficient based on the non-sensitive nature of the ground floor premises, it is recommended that impact sound insulation measures are considered. In order to minimise impact noise levels on the dance studio floor, the installation of a resilient layer under the proposed floor finish should be adopted. A product such as Regupol or SoundLay by CMS acoustics would be suitable, which come in a variety of thicknesses and should be selected depending on the anticipated footfall levels. It is important to note that all subsequent layers are floating. All layers above the resilient layer should also be isolated from the wall using a flanking strip.

7.0 CONCLUSION

A noise survey has been undertaken at 3-5 Red Lion Street, Richmond, TW9 1RJ. The results of the survey, combined with measured breakout of the building's sound insulation performance, have enabled the assessment of the noise impact of proposed activities on the nearest noise sensitive receivers.

Calculations have shown that noise breakout from the proposed dance studio to external receivers would not be expected be a cause of complaints when assessed according to BS4142:1997, without the need for any particular mitigation measures.

Measurements to internal receivers from music playback have been shown to meet the recommendations of the relevant British Standard for internal noise criteria.

Report by	Checked by
Max Foster TechIOA	**Florian Clement MIOA**

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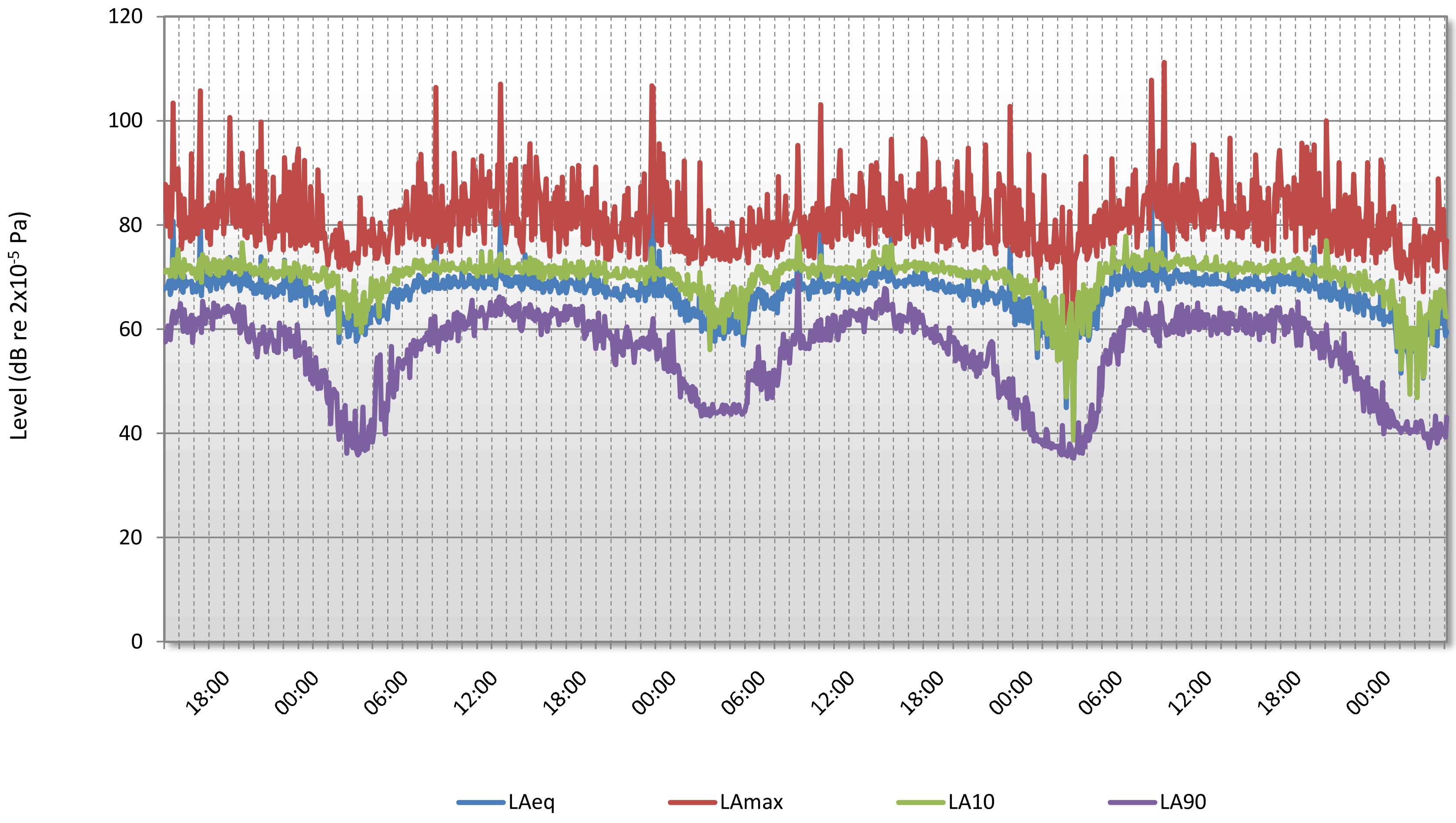
Environmental Noise Time History

18 October to 22 October 2013



8636-TH1

8636-SP1 Indicative site plan showing noise monitoring position and nearest noise sensitive receiver **Date:** 12 November 2013

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B1

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Acoustic Calculation used for Indoor to Outdoor Transmission:

$$SPL_{outdoor} = SPL_{indoor} - SRI_{composite} + 10\log_{10} S - 20\log_{10} r - 14$$

Receiver: Nearest Residential Premises
Source: Assumed Internal Noise Levels

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Sound Pressure Level Amplified music level from dance classes	73	76	77	79	75	72	68	71	80
Measured SRI of east facade, dB	-25	-28	-34	-39	-45	-48	-48	-48	
Correction for total facade area, 8.1 x 2.5m (S) (20.3m^2)	13	13	13	13	13	13	13	13	
Distance correction (r) (4m)	-12	-12	-12	-12	-12	-12	-12	-12	
Non-reverberant correction for indoor to outdoor transmission	-14	-14	-14	-14	-14	-14	-14	-14	
Correction for tonal / distinguishable noise emissions	5	5	5	5	5	5	5	5	
Sound pressure level at receiver	**40**	**40**	**35**	**32**	**22**	**16**	**12**	**15**	**32**

Minimum Measured LA90	50

APPENDIX B2

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Acoustic Calculation used for Room to Room Transmission:

$$SPL_{receiver} = SPL_{source} - SRI_{separation} + 10\log_{10} S - 10\log_{10} A$$

Receiver: Ground Floor Hairdressers
Source: Assumed Internal Noise Levels

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Sound Pressure Level									
Amplified music level from dance classes	73	76	77	79	75	72	68	71	80
Calculated Sound Reduction of existing separating floor, dB	-28	-31	-30	-31	-34	-33	-33	-33	
Correction for area of living room floor ($S = 140m^2$)	21	21	21	21	21	21	21	21	
Correction for receiver room absorption ($\alpha = 0.75$) $400m^2$	-25	-25	-25	-25	-25	-25	-25	-25	
Sound pressure level at receiver due to transmisison of noise	**41**	**41**	**43**	**44**	**37**	**35**	**31**	**34**	**44**

Design Criteria	**40-50**