www.clementacoustics.co.uk

London office
1B(c) Yukon Road
London
SW12 9PZ
Tel: 0203 475 2280

Manchester office
105 Manchester Road
Bury
BL9 0TD
Tel: 0161 850 2280

TEACHING BLOCK,

PARLIAMENT HILL SCHOOL, HIGHGATE ROAD, CAMDEN

NOISE IMPACT ASSESSMENT

Report **10883-NIA-01B RevB**

Prepared on 12 December 2018

Issued For:

Farrans Construction
New Cambridge House
Bassingbourn Road
Litlington nr Royston
SG8 0SS

Contents

List of Attachments

1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Farrans Construction to investigate and assess the possibility of noise emissions from proposed internal activities within the teaching block at Parliament Hill School, Highgate Road, Camden.

This report presents the results of a background noise survey and break out assessment followed by an assessment of the anticipated noise emission levels and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

As part of the proposed Teaching Block, a sports hall and design technology room will be created, which have the potential to generate noise emissions in internal spaces.

The Teaching Block is located towards the south of the school site, close to residential receivers.

The closest window to the noise generating rooms is at a minimum distance of 20 m from the closest Teaching Block facade.

An assessment has been carried out in order to investigate the anticipated level of noise breakout from the spaces and assess whether any particular mitigation measures are necessary.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Procedure

Measurements representative of receivers close to the Teaching Block were undertaken at one position as shown on indicative site drawing 10883-SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the site.

The microphone was mounted on the boundary of the site on a pole above the perimeter fence to the south of the site. The position was considered to be free-field according to guidance found in BS4142:2014, and a correction for reflections has therefore not been applied. Noise levels at the monitoring position were dominated by ongoing construction noise during the installation and collection of equipment. The survey duration was therefore chosen to ensure periods outside construction work hours were captured.

Continuous automated monitoring was undertaken for the duration of the survey between 15:00 on 2 October 2018 and 13:30 on 4 October 2018.

Weather conditions were generally dry with light winds, therefore suitable for the measurement of environmental noise.

The measurement procedure generally complied with BS 7445:1991: '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*'.

3.2 Equipment

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

The equipment used was as follows.

- 1 No. Svantek Type 977 Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

4.0 RESULTS

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured at the location shown in site drawing 10883-SP1.

The measured noise levels are shown as a time history in Figure 10883-TH1, with ambient and background noise levels summarised in Table 4.1.

	Average ambient noise level $L_{eq: T}$	Minimum background noise level $L_{90: 5min}$
Daytime (07:00 - 23:00)	68 dB(A)	36 dB(A)
Night-time (23:00 - 07:00)	43 dB(A)	29 dB(A)
Typical School Hours[1] (08:00 - 17:00)	70 dB(A)	46 dB(A)

Table 4.1: Average ambient and minimum background noise levels

[1] Typical school hours were extended either side in order to ensure periods unaffected by ongoing construction noise were considered when setting noise emissions criteria.

5.0 NOISE EMISSIONS CRITERIA

5.1 British Standard 4142

In order to assess the likely impact of the sports hall and technology rooms on nearby residential windows, we would suggest the comparison of anticipated noise emission levels to the minimum measured background noise levels (L_{A90}) and provide a rating of impact according to BS4142: 2014:*'Methods for rating and assessing industrial and commercial sounds'*.

British Standard 4142: 2014 can be seen as a good guide for assessing the suitability of varying (i.e. non-fixed) 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 rooms are for school use, this assessment will compare noise emissions to the extended school hours measured background noise level of 46 dB(A), in the absence of ongoing construction noise.

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 5 dB above the background noise level is likely to be an indication of an adverse impact. If the difference is of 10 dB or more, then this is stated as likely to be an indication of a significant adverse impact. Where the rating level does not exceed the background noise level, this is stated as an indication of the sound source having a low impact.

5.2 Lowest Observable Adverse Effect Level

Consideration has also been given to fixed criteria, which demonstrate the lowest observable adverse effect level [LOAEL]. The criteria are taken from British Standard 8233: 2014 '*Guidance on sound insulation and noise reduction for buildings*'.

Relevant recommended receiver levels are summarised in Table 5.1.

Activity	Location	Design range $L_{eq,T}$ Daytime (07:00-23:00)	Night-time (23:00-07:00)
External Amenity	Gardens / Outdoor Amenity Space	50 dB(A)	
Resting	Living Room	35 dB(A)	-
Dining	Dining Room/Area	40 dB(A)	-
Sleeping	Bedroom	35 dB(A)	30 dB(A)

Table 5.1: BS8233 recommended internal background noise levels

Annex G.1 of BS 8233: 2014 states the following with regards to the reduction provided by a typical external façade:

> "*If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB*."

Based on the above and having consideration that school activities will only occur during daytime hours, targeting a noise emission level of 50 dB(A) outside the nearest residential property would be expected to demonstrate compliance with all daytime requirements shown in Table 5.1.

6.0 NOISE IMPACT ASSESSMENT - INTERNAL ACTIVITIES

6.1 Proposed Activities

In order to predict worst case levels of noise anticipated from the use of the rooms, measurements have been taken from previous projects covering similar activities. The noise sources used are described as follows:

- Sports Hall: Measurements taken in a spinning class at a gymnasium. Particularly in terms of a constant level of noise over a daytime reference period, this is considered particularly robust.
- Design & Technology Classroom: Measurements taken in a commercial wood workshop. Machinery in use included nail guns, sanders, chop saws and hand tools.

The measured spectral noise levels for the above scenarios are shown in Table 6.1.

	Sound Pressure Level (dB) in each Frequency Band, at source								
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Spinning Class at Gymnasium	81	89	82	81	80	84	79	67	88
Commercial Wood Workshop	64	71	71	71	69	67	66	60	74

Table 6.1: Loudest Typical Measured Activity Noise Levels

These levels will be used to calculate the current noise breakout to nearby noise sensitive receivers.

For all calculated levels shown below, full formulae used and spectral calculations are shown in Appendix B.

6.2 Noise Breakout Assessment – Through External Facade

Residential windows have been identified at the location shown in attached site plan 10883-SP1B. The closest residential facades are located approximately 20 m from the closest point of the proposed school building facade.

The proposed external wall constructions for each space are summarised as follows (the option shown for the Sports Hall is the weaker of the two wall types used):

Sports Hall (Wall Type EW1)

- External aluminium cladding panels,
- 200mm insulation in c300mm void,
- 12mm cement particle board,
- 150mm c-stud with 100mm mineral wool,
- 15mm SoundShield inner lining

Design & Technology Room (EW2)

- Insulated render system (250mm insulation),
- 12mm cement particle board,
- 150mm c-stud with 100mm mineral wool,
- 15mm SoundShield inner lining

The wall systems shown above would be expected to provide sound reduction level of at least R_w 55 dB.

For the Design & Technology room, the weakest element of the external facade will be glazed elements. For the purposes of this assessment, it will be assumed that glazing could be formed of nominal double glazing, with a sound reduction level of R_w 30 dB.

6.3 BS 4142: 2014 Assessment

In a BS 4142 assessment, corrections are applied to noise levels in order to calculate a noise rating level for the effects of proposed activities on nearby noise sensitive receivers. This calculated receiver noise level is compared with the typical measured background noise level.

BS 4142 recommends penalties that can be applied to noise emissions to account for tonality and intermittency. Where a sound source is neither tonal nor impulsive, but is still distinctive against the residual acoustic environment, a penalty may still be applied.

The available penalties for different characteristics are summarised in Table 6.2.

Characteristic	Comments	Maximum Penalty
Tonality	Can be converted to 2 dB for a tone which is just perceptible, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible	6 dB
Impulsivity	Can be converted to 3 dB for impulsivity which is just perceptible, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible	9 dB
Distinctiveness	Intended for sources that are neither tonal nor impulsive, but distinctive against background noise sources	3 dB
Intermittency	When the sound has identifiable on/off conditions	3 dB

Table 6.2: Available penalties according to BS4142

The corrections applied to each noise source are summarised following:

- Sports Hall Noise Emissions (assumed spinning class),
    - Tonality: 6 dB.
- Design & Technology (assumed woodworking class),
    - Impulsivity: 6 dB,
    - Intermittency: 3 dB.

With internal activities at the above levels and proposed building performances adopted, noise emissions levels at nearest residential windows due to internal activities would be as shown in Table 6.3.

Levels have been calculated using the measured activity noise levels, the minimum specified sound reduction of the facades and the formula shown in Appendix B.

Receiver	Minimum School Hours Background Noise Level L90	Noise Level at Receiver (due to internal activity)
Closest Residential Receiver	46 dB(A)	30 dB(A)

Table 6.3: Noise levels and criteria at Receiver

As shown in Table 6.3 and Appendix B1, transmission of noise to the nearest sensitive windows due to the effects of the activities would provide a noise rating level of -16 dB. This would be classed as an indication of the sound source having a low impact as defined in the standard.

6.4 BS 8233: 2014 Assessment

For an assessment according to BS 8233: 2014, the penalties as stated in the previous section do not apply.

With internal activities at the above levels and proposed building performances adopted, noise emissions levels at nearest residential facade due to internal activities would be as shown in Table 6.4.

Levels have been calculated using the measured activity noise levels, the minimum specified sound reduction of the facades and the formula shown in Appendix B.

Receiver	Most Stringent LOAEL Criterion	Noise Level at Receiver (due to internal activity)
Closest Residential Receiver	50 dB(A)	22 dB(A)

Table 6.4: Noise levels and criteria at Receiver

As shown in Table 6.4 and Appendix B2, transmission of noise to the nearest sensitive windows due to the effects of the activities would be within the most stringent LOAEL criterion.

7.0 CONCLUSION

An assessment of noise breakout from internal activities has been undertaken for the proposed Teaching Block at Parliament Hill School, Highgate Road, Camden. The results of an environmental noise survey have enabled the assessment of noise propagation of proposed internal activities to surrounding receivers.

Calculations have been based on a worst case scenario of the Sports Hall and Design & Technology room to receivers, with a minimum proposed external building fabric performance.

Calculations have shown that the noise from activities within the facility would meet the set noise criteria.

Report by	Checked by
Duncan Martin MIOA	**Florian Clement MIOA**

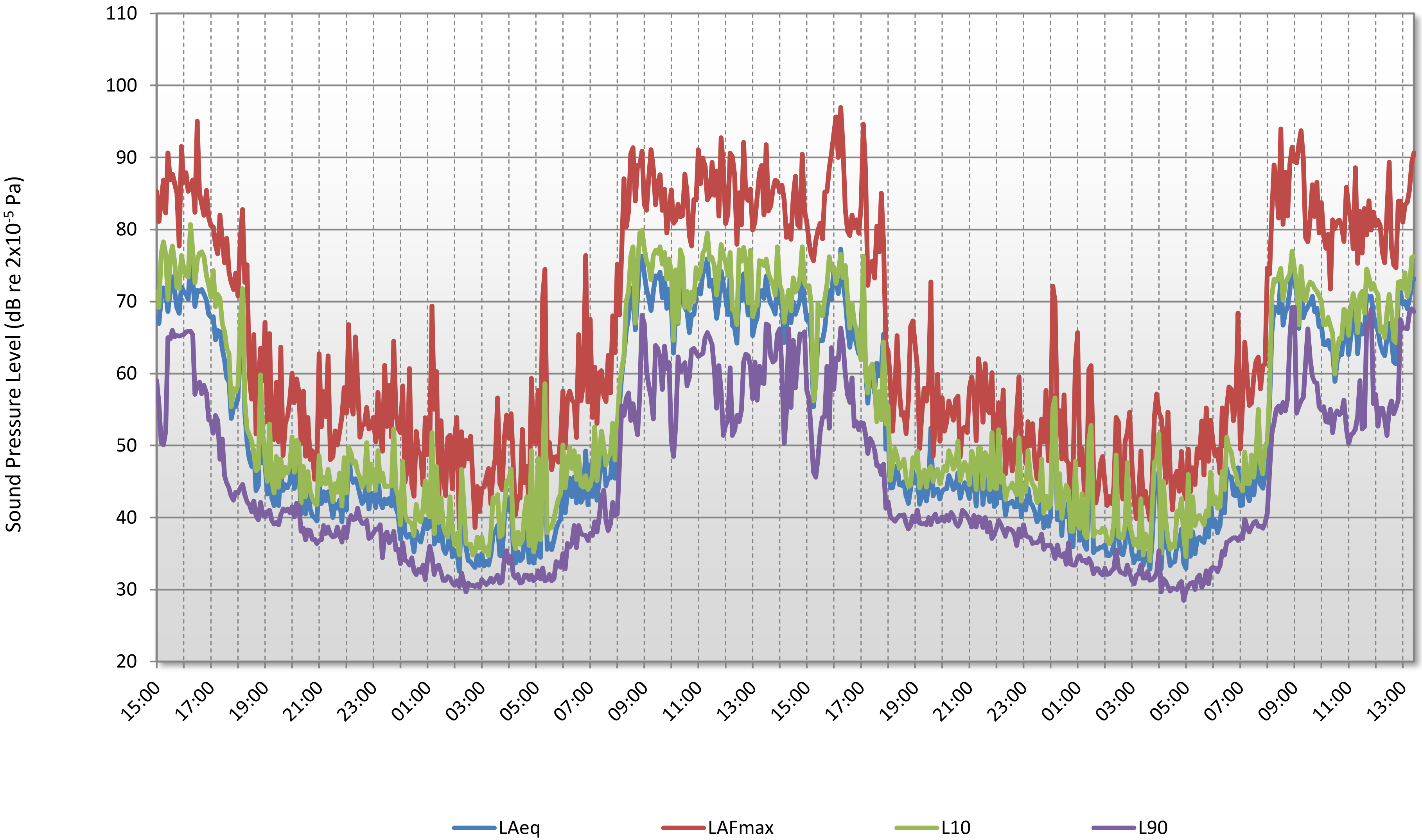
clement acoustics

10883-SP1 Indicative site plan indicating noise monitoring position and nearest noise sensitive receivers

Date: 12 December 2018

Parliament Hill School, Highgate Road, Camden

Environmental Noise Time History
2 October to 4 October 2018



10883-TH1

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 B

10883

Parliament Hill School, Highgate Road, Camden

Acoustic Calculation used for Indoor to Outdoor Transmission:

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

APPENDIX B1: Noise Breakout Assessment to BS4142

Source: Sports Hall and Design & Technology Activities

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Measured Sound Pressure Level									
Measured source noise level at gymnasium spinning class	81	89	82	81	80	84	79	67	88
Sound Reduction of weakest facade (EW1), dB (SRI)	-25	-32	-46	-53	-55	-55	-55	-55	
Correction for total area of building facade (S = 60m^2)	17	17	17	17	17	17	17	17	
Correction for distance (r) (r = 20m)	-26	-26	-26	-26	-26	-26	-26	-26	
Non reverberant correction	-14	-14	-14	-14	-14	-14	-14	-14	
Correction for tonal noise emissions	6	6	6	6	6	6	6	6	
Sound pressure level at receiver due to Sports Hall	**39**	**40**	**19**	**11**	**8**	**12**	**7**	**-5**	**25**
Internal Measured Sound Pressure Level									
Measured source noise level in wood workshop	64	71	71	71	69	67	66	60	74
Sound Reduction of weakest facade (nominal glazing), dB (SRI)	-18	-20	-22	-28	-33	-34	-28	-30	
Correction for total area of building facade (S = 20m^2)	13	13	13	13	13	13	13	13	
Correction for distance (r) (r = 20m)	-26	-26	-26	-26	-26	-26	-26	-26	
Non reverberant correction	-14	-14	-14	-14	-14	-14	-14	-14	
Correction for impulsive and intermittent noise emissions	9	9	9	9	9	9	9	9	
Sound pressure level at receiver due to Design & Technology	**28**	**33**	**31**	**25**	**18**	**15**	**20**	**12**	**28**
Cumulative sound pressure level at receiver	**39**	**41**	**31**	**25**	**18**	**17**	**20**	**12**	**30**

APPENDIX B2: Noise Breakout Assessment to BS8233

Source: Sports Hall and Design & Technology Activities

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Internal Measured Sound Pressure Level									
Measured source noise level at gymnasium spinning class	81	89	82	81	80	84	79	67	88
Sound Reduction of weakest facade (EW1), dB (SRI)	-25	-32	-46	-53	-55	-55	-55	-55	
Correction for total area of building facade (S = 60m^2)	17	17	17	17	17	17	17	17	
Correction for distance (r) (r = 20m)	-26	-26	-26	-26	-26	-26	-26	-26	
Non reverberant correction	-14	-14	-14	-14	-14	-14	-14	-14	
Sound pressure level at receiver due to Sports Hall	**33**	**34**	**13**	**5**	**2**	**6**	**1**	**-11**	**19**
Internal Measured Sound Pressure Level									
Measured source noise level in wood workshop	64	71	71	71	69	67	66	60	74
Sound Reduction of weakest facade (nominal glazing), dB (SRI)	-18	-20	-22	-28	-33	-34	-28	-30	
Correction for total area of building facade (S = 20m^2)	13	13	13	13	13	13	13	13	
Correction for distance (r) (r = 20m)	-26	-26	-26	-26	-26	-26	-26	-26	
Non reverberant correction	-14	-14	-14	-14	-14	-14	-14	-14	
Sound pressure level at receiver due to Design & Technology	**19**	**24**	**22**	**16**	**9**	**6**	**11**	**3**	**19**
Cumulative sound pressure level at receiver	**33**	**34**	**23**	**16**	**10**	**9**	**11**	**3**	**22**