ROYAL CENTRAL
SCHOOL OF SPEECH & DRAMA
UNIVERSITY OF LONDON

The Royal Central School of Speech and Drama

'Phase 5' – Studio 1 Redevelopment

Noise Impact Assessment

Sandy Brown Associates

November 2014

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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The Royal Central School of Speech and Drama

Planning noise report

55 Charterhouse Street, London EC1M 6HA
Piccadilly House, 49 Piccadilly, Manchester M1 2AP
16 West Terrace, South Queensferry EH30 9LL

T: +44 (0)20 7549 3500
T: +44 (0)161 771 2020
T: +44 (0)131 331 2020

post@sandybrown.com
www.sandybrown.com

Sandy Brown Associates LLP
Registered in England & Wales No. OC 307504

Registered Office: 55 Charterhouse Street, London EC1M 6HA

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A	18 Nov 14	Draft for comment	Andrew Long	Stephen Stringer
B	20 Nov 14	Final version	Andrew Long	Stephen Stringer
C	25 Nov 14	Minor updates	Andrew Long	Stephen Stringer

Summary

Sandy Brown Associates LLP (SBA) has been appointed by The Royal Central School of Speech and Drama (Central) in Swiss Cottage, London to provide acoustic design advice in relation to Phase 5 of their campus masterplan.

In order to accompany the planning application for this proposed new studio building, an environmental noise survey has been undertaken in order to establish existing ambient and background noise levels within the vicinity of the site.

The results of the survey have been used to develop the design of the building in relation to both noise ingress and noise egress.

The results of the survey and the associated derived plant noise limits are presented herein, along with the results of an assessment of noise emissions associated with the operation of the proposed building.

Background noise levels at a location considered to be representative of the nearest noise sensitive receptors were measured to be L_{A90} 48 dB for the proposed period of operation. The corresponding noise limit for the cumulative operation of all plant associated with the proposed building is therefore 43 dBA at 1 meter from the nearest noise sensitive receptor, in accordance with the London Borough of Camden's planning policy.

The assessment finds that the proposed plant attenuation measures are such that the criteria detailed herein are achieved when assessed at the location of the nearest noise sensitive receptors.

The facade sound insulation to the proposed building has been designed such that noise levels at nearby receptors are in line with the criteria recommended herein.

Contents

1 Introduction

Sandy Brown Associates LLP (SBA) has been appointed by The Royal Central School of Speech and Drama (Central) in Swiss Cottage, London to provide acoustic design advice in relation to the Studio 1 redevelopment, 'Phase 5' of their campus masterplan.

In order to accompany the planning application for this proposed new studio building, an environmental noise survey has been undertaken.

The purpose of the survey was to establish the existing background noise levels in the vicinity of nearby noise sensitive premises. The background noise levels measured enable appropriate limits to be set regarding noise emission from proposed building services plant, in accordance with the requirements of the London Borough of Camden (LBC).

This report presents the survey method, results of the environmental noise survey, a discussion of acceptable limits for noise emission from building services plant, and an assessment of noise emissions associated with the proposed building.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1.

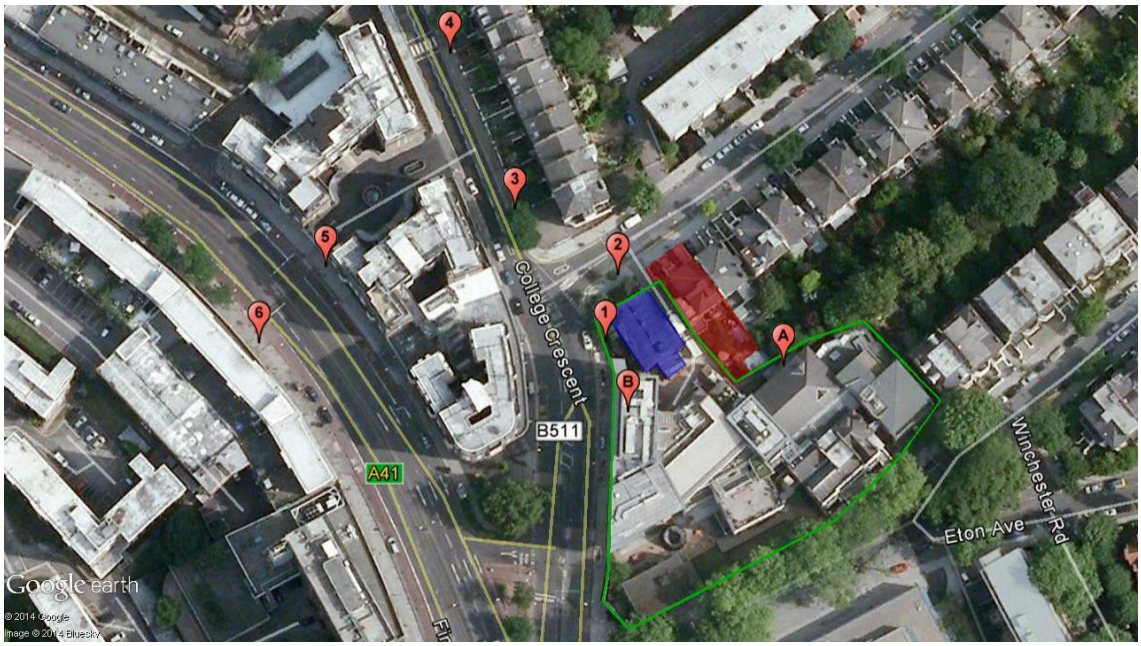


Figure 1 Central and the surrounding area, courtesy of Google Earth Pro

Figure 1 shows the Phase 5 site relative to the surrounding area. The unattended noise logging locations are denoted by the letters A and B. The attended noise measurement locations are denoted by the numbers 1 to 6. The site boundary line is highlighted green with the existing section to be developed highlighted in blue and the nearest noise sensitive receptor highlighted in red.

The main roads local to Central are Finchley Road running from west to south, and College Crescent which runs from north to south. Buckland Crescent is a smaller road which leads onto College Crescent just north of Central.

2.2 Adjacent premises

Residential premises located directly to the north and east of the site and are considered to be the nearest noise sensitive receptors, the closest of these are highlighted in red in Figure 1.

The west side of College Crescent, opposite Central, is populated with commercial buildings and restaurants at ground floor level and residences above.

3 Method

3.1 Unattended measurements

A six day unattended continuous noise logging survey was undertaken at two locations at the site to determine the existing background noise levels in the vicinity of nearby noise sensitive premises.

The measurement positions used during the survey are indicated in Figure 1 denoted by the letters A and B. Photographs showing the measurement locations are provided in Figure 2 and Figure 3, respectively.

Measurements at position A were made at 1st floor level at the rear of the existing Studio 1 building between 13:20 on 20 March 2014 and 14:05 on 26 March 2014, and were considered to be reasonably representative of those experienced by the nearest noise sensitive premises to the rear of the building, such as the rear of the properties along Buckland Crescent.

At measurement Location B, the microphone was mounted on a boom fixed to a tripod above roof level of the existing West Block at Central. Noise measurements performed at Location B were made between 13:15 on 20 March 2014 and 13:25 on 26 March 2014, in order to establish ambient noise levels in the vicinity of the proposed building and also to provide an understanding of the likely background noise levels at the noise sensitive premises along College Crescent. It is noted, however, that background (L_{90}) noise levels at this location may have been affected by noise associated with nearby roof-top plant serving Central's other buildings.

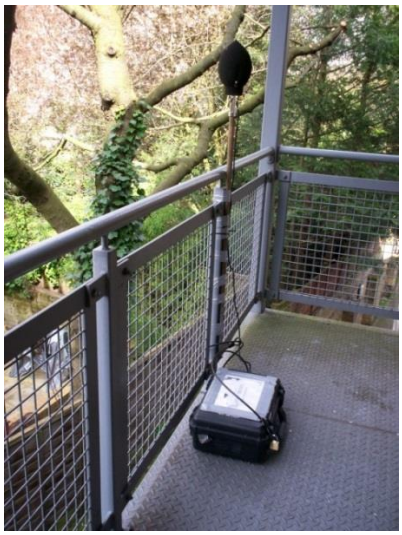


Figure 2 Unattended noise logging location A

Figure 3 Unattended noise logging location B

3.2 Attended measurements

Attended sample measurements were performed at a number of different locations around Central. These are indicated in Figure 1 as positions 1 to 6. Attended measurements were carried out at position 1 and 2 on 20 March 2014 over 15 minute periods. Further attended measurements were carried out at positions 1 to 6 on 26 March 2014 over 15 minute periods.

Attended measurements were carried out in order to determine the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

The locations of the measurements are indicated in Table 6. In each case the microphone was mounted on a tripod approximately 1.5 m above the ground level and at least 2 m from any other reflective surface.

3.3 Equipment

A Rion NL-52 sound level meter and a Svantek 957 sound level meter were used to undertake the unattended measurements at locations A and B, respectively.

The attended measurements carried out on 20 March 2014 were performed using a Bruel & Kjaer 2260 sound level meter. The attended measurements carried out on 26 March 2014 were performed using a Bruel & Kjaer 2260 sound level meter and a Svantek 948 sound level meter. The calibration data for the equipment used during the survey is provided in Appendix A to this report.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

3.4 Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T
- $L_{Amax,T}$ The A-weighted maximum sound pressure level that occurred during a given period. Measured using the fast time weighting
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background noise level.

The L_{A90} is considered most representative of the background noise level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

3.5 Weather conditions

The weather conditions for the attended measurements are provided in Table 1.

Table 1 Weather conditions during attended measurements

Date	Temperature range	Precipitation	Wind speed
20 March 2014	6° to 13°	N/A	Less than 5 m/s
26 March 2014	4° to 9°	N/A	Less than 5 m/s

During the unattended noise measurements between 20 March 2014 and 26 March 2014, weather reports for the area indicated that temperatures varied between -1°C at night and 14°C during the day, and the wind speed was less than 5 m/s.

Showers occurred during the unattended noise measurements however there were sufficient dry periods to obtain representative background noise readings.

These measurements are considered to have obtained a representative sample of noise data.

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of road traffic noise from College Crescent and Finchley Road. Less significant noise sources included pedestrian activity.

4.2 Unattended measurement results

4.2.1 Location A

The results of the unattended noise measurements performed at the site are summarised in the following tables. A graph showing the results of the unattended measurements at Location A are provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 2.

Table 2 Ambient noise levels measured during the survey – Location A

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 20 March 2014	54*	50
Friday 21 March 2014	53	52
Saturday 22 March 2014	53	49
Sunday 23 March 2014	52	48
Monday 24 March 2014	54	48
Tuesday 25 March 2014	54	48
Wednesday 26 March 2014	58*	-
Average	54	49

* Measurement not made over full period due to monitoring start and end time; not included in the average

The representative background noise levels have been determined by a statistical analysis of the range of measured background noise levels, in accordance with guidance presented within BS 4142:2014, and are presented in Table 3.

Table 3 Representative background noise levels measured during the survey – Location A

Date	Daytime (07:00 – 23:00) $L_{A90,5min}$ (dB)	Night (23:00 – 07:00) $L_{A90,5min}$ (dB)
Thursday 20 March 2014	50 *	45
Friday 21 March 2014	51	47
Saturday 22 March 2014	50	46
Sunday 23 March 2014	48	45
Monday 24 March 2014	50	45
Tuesday 25 March 2014	50	45
Wednesday 26 March 2014	51 *	-
Overall - Weekday	50	45
Overall - Weekend	48	45

* Measurement not made over full period due to monitoring start and end time

4.2.2 Location B

The results of the unattended noise measurements performed at the site are summarised in the following tables. A graph showing the results of the unattended measurements at Location B are provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 4.

Table 4 Ambient noise levels measured during the survey – Location B

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 20 March 2014	66*	63
Friday 21 March 2014	66	64
Saturday 22 March 2014	65	63
Sunday 23 March 2014	66	61
Monday 24 March 2014	65	62
Tuesday 25 March 2014	67	62
Wednesday 26 March 2014	67*	-
Average	66	62

* Measurement not made over full period due to monitoring start and end time; not included in the average

The representative background noise levels have been determined by a statistical analysis of the range of measured background noise levels, in accordance with guidance presented within BS 4142:2014, and are presented in Table 5.

Table 5 Representative background noise levels measured during the survey – Location B

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Thursday 20 March 2014	61 *	50
Friday 21 March 2014	60	53
Saturday 22 March 2014	61	51
Sunday 23 March 2014	60	47
Monday 24 March 2014	60	48
Tuesday 25 March 2014	61	49
Wednesday 26 March 2014	61 *	-
Overall - Weekday	61	50
Overall - Weekend	60	47

* Measurement not made over full period due to monitoring start and end time

4.3 Attended measurement results

Attended measurements were performed at a number of different locations around the site on 20 March 2014 and 26 March 2014. The sound pressure levels recorded during these measurements are summarised in Table 6 in terms of the most notable parameters. All the attended measurements were performed over 15 minute periods.

Table 6 Sound pressure levels from attended measurements

Position	Start date/time	Sound pressure levels (dB)		
		$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A90,15min}$
1	20 March 13:30	68	84	63
1	20 March 14:15	68	85	62
1	20 March 14:45	72	97	63
1	26 March 10:30	79	103	63
1	26 March 10:45	69	81	63
2	20 March 13:45	65	83	59
2	20 March 14:30	65	79	59
2	20 March 15:00	66	86	61
2	26 March 10:30	80	107	61
2	26 March 10:45	68	93	60
3	26 March 11:15	70	91	63
3	26 March 11:30	70	90	62
4	26 March 11:15	72	84	62
4	26 March 11:30	72	91	61
5	26 March 12:00	76	94	66
5	26 March 12:15	77	98	66
6	26 March 12:00	73	89	65
6	26 March 12:15	74	88	66

5 Building services noise egress

5.1 Criteria

5.1.1 Standard guidance

Standard guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014'*Method for rating and assessing industrial and commercial sound'*.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background noise levels at the nearest noise sensitive receptors to assess the significance of noise impacts.

The standard introduces the concept of a rating sound level which is the specific sound level (ie plant noise level) at the location of the receptor in addition to corrections for acoustic features such as tonality and impulsivity, etc.

BS 4142 states that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. The standard does on to state that an initial estimate of the impact of the sound should be obtained by subtracting the measured background sound level from the rating level, considering the following:

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

5.1.2 Local Authority criteria

Noise limits for plant shall be set in accordance with the LBC planning policy, as set out in Development Policy DP28.

In summary, the cumulative noise level emitted from all new plant should not exceed 5 dB below the existing background noise level (L_{A90}), when assessed at 1 m outside the nearest noise sensitive facade, during the proposed hours of operation.

If the plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve an additional 5 dB below this limit.

5.1.3 Building services noise limits

Based on LBC's criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the most affected windows of the nearest noise sensitive premises should not exceed 5 dB below the existing background noise level. These limits are set out in Table 7.

Table 7 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises (dB)	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Weekday	45	40
Weekend	43	40

The results of the survey at Location B indicate higher background noise levels are likely to be incident on the facades of the residential premises to the west of the site on the opposite side of College Crescent. However, background noise levels measured at this location may not necessarily be considered to be representative of those at these premises due to the location of the measurement in relation to the sensitive facades.

Instead, and in order to provide a robust/worst-case assessment, the noise limits detailed in Table 7 could be used for these premises.

5.2 Proposed building services plant

The general strategy is to naturally ventilate office and meeting rooms, and to provide ventilation to the studios with dedicated air handling plant located either at basement level, at 1st, 3rd & 5th floor level and at roof level, along with toilet extract and MVHR plant also at roof level.

In addition, a new chiller serving the building is to be located within an existing plant enclosure upon the roof of the West Block.

Preliminary plant selections have been made and an initial assessment has been made on the basis of noise data received from Max Fordham (the M & E engineer). The proposed plant items are listed in Table 8 and the received plant noise data is detailed in Table 9.

It is understood that the plant will be in operation during the weekday and weekend daytime periods (07:00 – 23:00) but not overnight, and as such a criterion of 43 dBA at 1 m from the nearest noise sensitive premises is applicable.

Table 8 Proposed plant items

Ref	Item	Location	Serving	Model	N off
1	AHU 1	Basement	Studio A	GEA COM4plus	1
2	AHU 2	Roof	Studio B	GEA CAIRplus SX	1
3 & 4	F1	Studio C plant	Studio C	Systemair MUB025	2
5 & 6	F1	Studio D plant	Studio D	Systemair	2
7 & 8	F1	Studio E plant	Studio E	Systemair	2
9	F3	Roof	WC extract	Vent-Axia ACM 150	1
10	MVHR 1	Roof	WCs & changing rooms	Vent-Axia Lo Carbon Sentinel Kinteic Plus	1
11	Chiller	West block roof	Phase 5	Ultima compact	1

Table 9 Plant noise data received from Max Fordham

Ref	Atmospheric source	Sound power level, L_W (dB), at octave band centre frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
1	Inlet	68	77	67	64	59	57	54	49
	Discharge	75	84	78	76	75	71	67	61
2	Inlet	69	66	67	61	55	58	57	55
	Discharge	69	72	80	75	73	68	64	62
	Breakout	59	60	65	55	51	45	44	32
3 to 8	Inlet	45	63	66	71	66	69	69	60
	Discharge	45	71	66	70	71	69	66	58
9	Inlet	50	53	59	60	57	61	53	47
	Discharge	53	52	59	61	58	61	54	46
	Breakout	50	50	55	53	49	50	38	32
10	Inlet	55	62	71	70	63	58	42	38
	Discharge	54	55	66	58	47	41	34	40
	Breakout	57	55	41	41	47	46	37	40
11	Unit	80	84	82	76	75	69	63	

5.3 Attenuation

Ducted attenuators are to be fitted between the fan and the atmospheric terminations of the discharge to AHU 1, and both the inlet and discharge of each Studio fan F1, to achieve the insertion losses detailed in Table 10.

Table 10 Recommended minimum insertion loss for attenuators

Ref	Atmospheric source	Minimum insertion loss (dB), at octave band centre frequency (Hz)						
		125	250	500	1k	2k	4k	8k
1	Discharge	8	8	14	14	14	8	8
3 to 8	Inlet	12	15	23	23	23	18	13
	Discharge	15	16	23	23	23	18	13

It is important that any attenuator be selected such that airflow regenerated noise does not increase the resultant noise level between the attenuator and the termination.

5.4 Assessment

Taking into account source directivity, screening and distance between the proposed plant items and the nearby receptors, the assessment indicates that noise emissions will be in line with the proposed plant noise criterion of 45 dBA when assessed at 1 m from the nearest noise sensitive premises.

6 Noise break-out from studios

6.1 Criteria

Although not strictly applicable as the development is not considered a place of entertainment, the London Borough of Camden's Development Policy 28 (DP28) includes requirements for the control of 'noise levels from places of entertainment at which planning permission will not be granted'. For daytime and evening operation, DP28 suggests that for noise at 1 m external to a sensitive facade, the $L_{Aeq,5min}$ shall not be increased by more than 5 dB.

Further to this, and to reduce the likelihood of complaints arising from nearby residential receptors, it is recommended that the average noise levels associated with the operation of the studios be controlled such that they are in line with the measured background (L_{A90}) noise levels at the receptor locations.

The results of the survey (refer to Section 4.2) indicate that, when averaged over the entire daytime and evening periods, the typical ambient noise level in the vicinity of the nearest noise sensitive receptors is $L_{Aeq,16hr}$ 54 dB. The representative background noise level during the operational periods, however, was measured to be L_{A90} 48 dB.

Based on the Local Authority criteria for places of entertainment, a noise egress level of around $L_{Aeq,5min}$ 55 dB would be acceptable. However, to reduce the likelihood of complaints and in line with the criteria suggested above, it is recommended that noise egress from the studios is controlled to $L_{Aeq,T}$ 48 dB.

6.2 Strategy

The upper level studios (Studios B, C, D & E) are to have mixed mode ventilation and be naturally ventilated whenever possible. However during times when quiet conditions are required within the studio and/or activity noise levels are high (eg from amplified sound during a performance), the studios will be served with well attenuated mechanical ventilation in order to achieve the internal noise criteria.

The basement TV studio (Studio A) will not have any windows and will be served by dedicated air-handling plant located in the basement plant room. The ground floor studio (Studio B) will also be served by dedicated air handling plant located at roof level.

The sound insulation afforded by the building envelope including solid elements and fenestration, etc, has been specified such that noise break-out associated with the operation of the studios is in line with the proposed criterion detailed in Section 6.2.

7 Conclusion

A noise survey has been carried out to determine the existing noise levels in the vicinity of the site. The representative measured background noise levels measured at Location A were L_{A90} 48 dB during the weekday & weekend daytime, and L_{A90} 45 dB during the night.

On the basis of the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 43 dB during the day and L_{Aeq} 40 dB during the night. These limits are cumulative, and apply with all plant operating under normal conditions. If the plant items contain tonal or attention catching features, the limits will be 5 dB more stringent than those set out above.

An assessment of noise emissions associated with the proposed plant selections along with recommended attenuation indicates that plant noise emissions would be in line with the Local Authority's standard criteria.

Facade sound insulation performances have been specified such that noise egress associated with the operation of the studios is suitably controlled at the location of nearby noise sensitive receptors.

Appendix A

Equipment calibration information

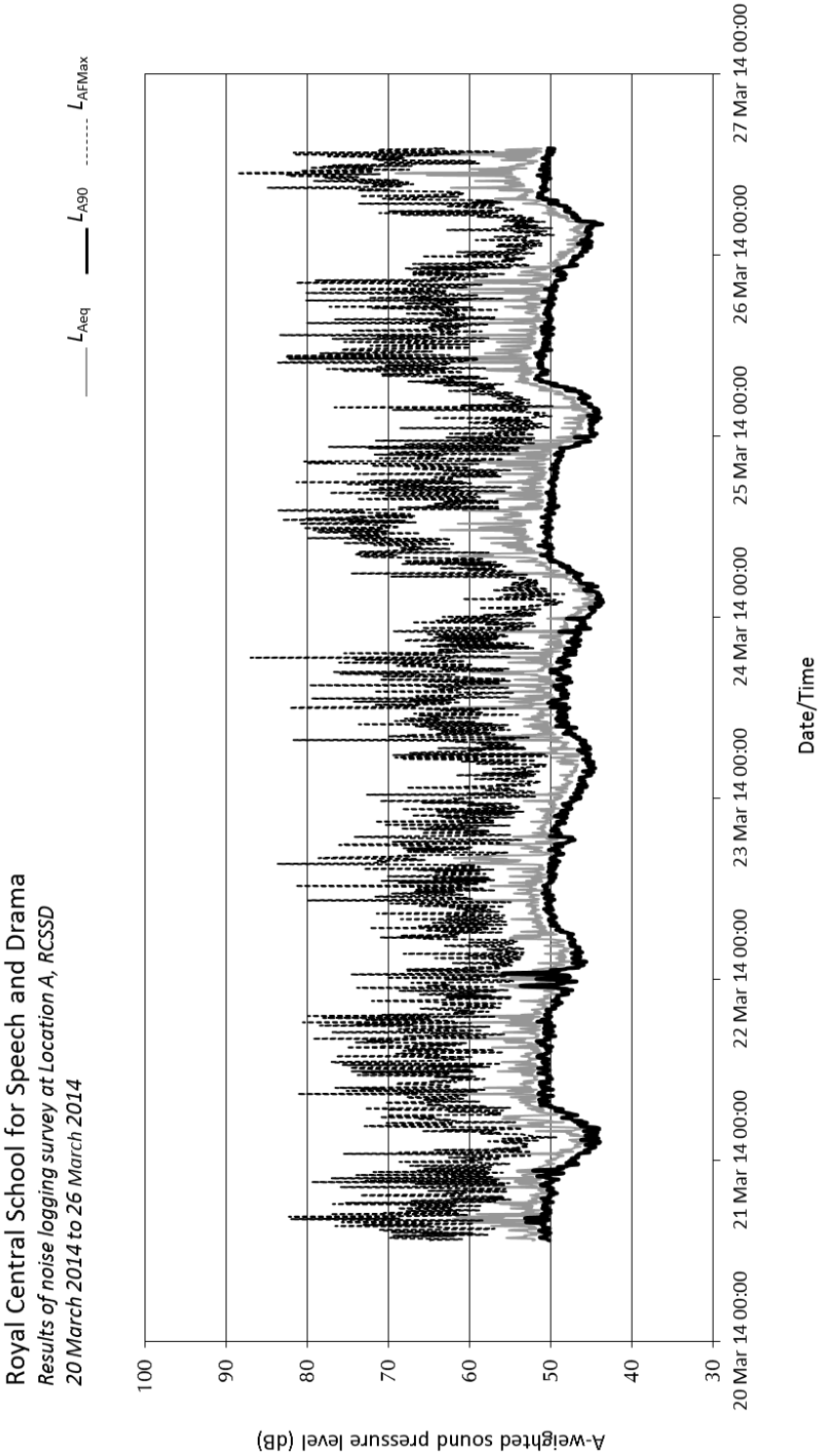
Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	2260/2459184	Bruel & Kjaer	23 Jul 15	07254/07255
Microphone	4189/2573753	Bruel & Kjaer	23 Jul 15	07254/07255
Calibrator	4231/2459806	Bruel & Kjaer	23 Jul 15	07251
Sound level meter	SVAN948/9365	Svantek	2 Apr 15	1304131
Microphone	SV22/4013841	Svantek	2 Apr 15	1304131
Calibrator	SV30/10569	Svantek	2 Apr 15	1304129
Sound level meter	SVAN957/12327	Svantek	23 Oct 15	1310490
Microphone	ACO7052H/43273	Svantek	23 Oct 15	1310490
Calibrator	SV30A/7451	Svantek	23 Oct 15	1310484
Sound level meter	NL-52/00320633	Rion	12 Apr 14	1204155
Microphone	UC-59/03382	Rion	12 Apr 14	1204155
Calibrator	N7-74/34125430	Rion	12 Apr 14	1204151

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meter(s) used in this survey are available upon request.

Appendix B

Results of unattended measurements


Royal Central School for Speech and Drama
Results of noise logging survey at Location A, RCSSD
20 March 2014 to 26 March 2014
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
20 Mar 14 00:00
21 Mar 14 00:00
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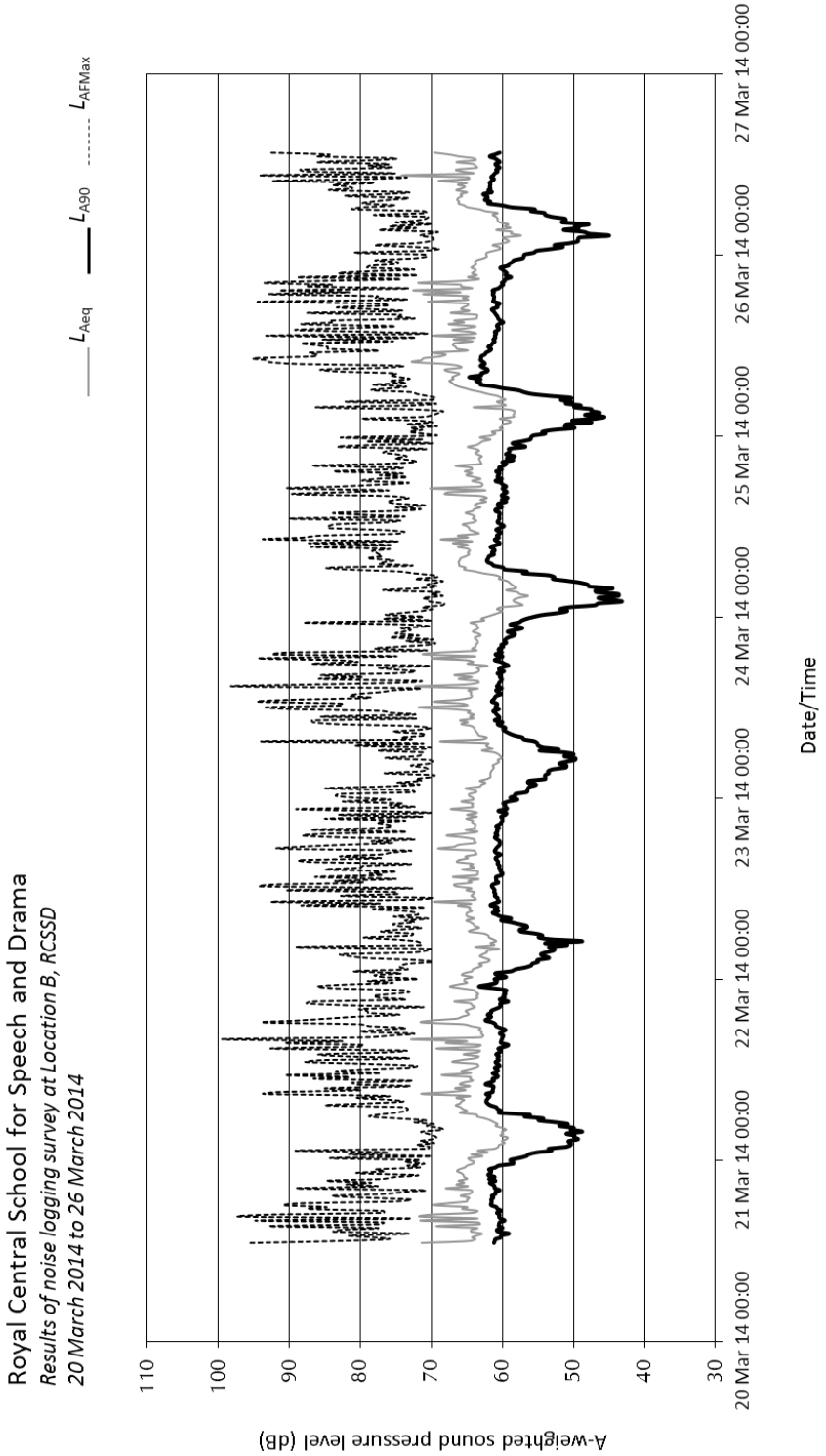
Royal Central School for Speech and Drama
Results of noise logging survey at Location B, RCSSD
20 March 2014 to 26 March 2014
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
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20 Mar 14 00:00
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