Acoustic Associates Sussex Ltd

Planning Application Noise Assessment (Road)

Site: 6-8 High Street, Shoreham
Client: Stephen Bromley Associates

Report by: Simon Barrett BSc(Hons) MSc MIOA

Date: 31st March 2015
Project: J1734

ADUR & WORTHING PLANNING SERVICES	
PLAN	AWDM/ 1127/14
DATE VALID	- 8 JUN 2015

ANC THE ASSOCIATION OF NOISE CONSULTANTS

ATTMA

BINDT

Acoustic Associates

Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPG24 - Schools Acoustics BB93 - Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

Part of the Acoustic Associates Group of consultancies:
DEVON HUMBERSIDE LEICESTERSHIRE NOTTINGHAMSHIRE PETERBOROUGH **SUSSEX** WESSEX WORCESTERSHIRE

Acoustic Associates Sussex Ltd., 8 Highdown House, Shoreham Airport, Shoreham-by-Sea, West Sussex BN43 5PB
Tel: (01273) 455074 Fax: (01273) 455075 e-mail: info@aasussex.co.uk **www.aasussex.co.uk**

Contents

1 Introduction ..... - 2 -

2 Context, Noise Criteria & Noise Assessment Methodology ..... - 3 -

2.1 Context ..... - 3 -

2.2 National Planning Policy Framework 2012 ..... - 3 -

2.3 BS8233 Noise Criteria ..... - 3 -

2.4 WHO Noise Criteria ..... - 4 -

2.5 Local Authority's Planning Condition ..... - 4 -

3 Road Noise Survey Baseline Conditions and Results ..... - 5 -

3.1 Baseline Conditions ..... - 5 -

3.2 Road Noise Survey Results ..... - 6 -

4 Noise Assessment ..... - 7 -

4.1 Daytime and Night Time LAeq Noise Levels ..... - 7 -

4.2 Night Time Maximum Noise Levels ..... - 7 -

5 Mitigation Measures ..... - 8 -

5.1 Noise Mitigation Measures Noise Criteria ..... - 8 -

5.2 Glazing ..... - 8 -

5.3 Mechanical Ventilation ..... - 8 -

5.4 Outdoor Amenity Areas ..... - 9 -

5.5 Sound Insulation of dormers, skeilings and ceilings and internal leaf of front façade ..... - 9 -

6 Conclusion ..... - 10 -

Appendix A – BS8233 Rigorous Calculation ..... - 11 -

Appendix B – Calibration Certificates ..... - 12 -

Acoustic Associates

Tables

Table 1: BS8233 Criteria ..... - 3 -
Table 2: Free-field Day & Night time Leq noise levels at measurement position (A-Weighted) ..... - 6 -
Table 3: Comparison of Noise levels against BS8233 criteria ..... - 7 -
Table 4: Night time Lmax values exceeding 60dB just outside façade ..... - 7 -
Table 5: Minimum Required Glazing for most exposed façade ..... - 8 -

Figures

Figure 1: Noise Measurement Location ..... - 5 -
Figure 2: Measured road noise levels at survey position: free-field converted ..... - 6 -

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

Report by: Simon Barrett BSc(Hons) MSc MIOA
Checked by: Peter Attwood BSc MSc MCIOB MIOA MIDiagE

Issue 1	31/03/2015

Acoustic Associates

1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment of road noise affecting the proposed redevelopment of 6 - 8 High Street, Shoreham, BN43 5DA from offices to flats on the first and second floors.

The purpose of this assessment is to assess the following:

- Road Traffic Noise Levels affecting the proposed development.
- Mitigation Measures to reduce internal noise levels.

The development will convert the existing office space into dwellings.

Transportation (road) noise has been measured on the existing site (pre conversion).

The noise levels for the day and the night time period have been assessed in terms of and following the guidelines of the documents listed below:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- BS8233 (Guidance on sound insulation and noise reduction for buildings) 2014

Noise mitigation measures have been recommended and if they are implemented by the developer it is considered that the planning condition relating to road noise would be discharged on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

It is proposed that the existing office space on the first and second floors to 6-8 High Street, Shoreham is to be redeveloped to form residential dwellings comprising of 8 flats/apartments.

The site is bounded by one major road; High Street road which runs past its south façade. This road is a general route for through-traffic serving commuters, general shoppers, commercial vehicles and heavy goods vehicles.

All around the site are existing dwellings and small businesses, with the only exposed façade being the southern one, which faces the High Street.

Planning has been approved but with the inclusion of some conditions. The condition relating to noise is included within this report, see section 2.5.

2.2 National Planning Policy Framework 2012

Previously planning policy guidance notes set out the Government's policies on different aspects of planning. Until recently, it was the case that Local Authorities must take their content into account in preparing their development plans. They may be material to decisions on individual planning applications and appeals.

PPG24 (relating to noise) has recently been withdrawn, following the introduction of the National Planning Policy Framework 2012 document (which is not meant to be a replacement for PPG24). This later document places the onus on Local Authorities to implement their own local criteria. Based upon Local Authority guidance documents it is recommended in this case that appropriate criteria are provided by:

- BS8233 (Guidance on sound insulation and noise reduction for buildings) 2014
- World Health Organisation (WHO) - Guidelines for Community Noise 1999

Assessment methodology, predictions of building envelope sound insulation and calculations of noise propagation will follow the principles detailed within:

- BS8233 (Guidance on sound insulation and noise reduction for buildings) 2014

2.3 BS8233 Noise Criteria

Table 5 of BS8233 provides the following guideline values:

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

Table 1: BS8233 Criteria

Annex G of BS8233:2014 states that if partially open windows were relied upon for background ventilation, the insulation of the building envelope would be reduced to approximately 15 dB

2.4 WHO Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type	**Target Maximum Internal Level - L_{Aeq} dB (A)**
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)
Room Type	**Maximum Internal Level – L_{Amax} dB(A)**
Bedrooms	45 (not more than 10-15 times per Night)

The target internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. Internal noise levels above 30dB (A) are likely to cause sleep disturbance. WHO state that the noise level outside a partially open bedroom window should be less than 45dB(A) this assumes that an open window provides 15dB attenuation.

The target maximum internal noise level (Lmax) for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the internal, night-time Lmax within a bedroom should be no higher than 45dBA on more than 10-15 occasions per night.

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.5 Local Authority's Planning Condition

Planning condition 4 relating to this development states the following:

The development hereby permitted shall not be commenced until a scheme for protecting the proposed flats from road traffic noise has been submitted to and approved in writing by the Local Planning Authority. All works which form part of the scheme shall be completed before the permitted flats are occupied and shall specifically include the provision of a whole house ventilation system and acoustic double glazing to windows of habitable rooms facing the High Street to provide an internal sound environment of 35dB(A).

***Reason**: In the interests of residential amenity and to comply with policy AG1 of the Adur District Local Plan.*

3 Road Noise Survey Baseline Conditions and Results

A noise survey was carried out from 5th to 13th March 2015 in order to measure noise levels associated with road traffic. The noise monitoring location can be seen in the figure below, provided courtesy of Ordinance Survey.

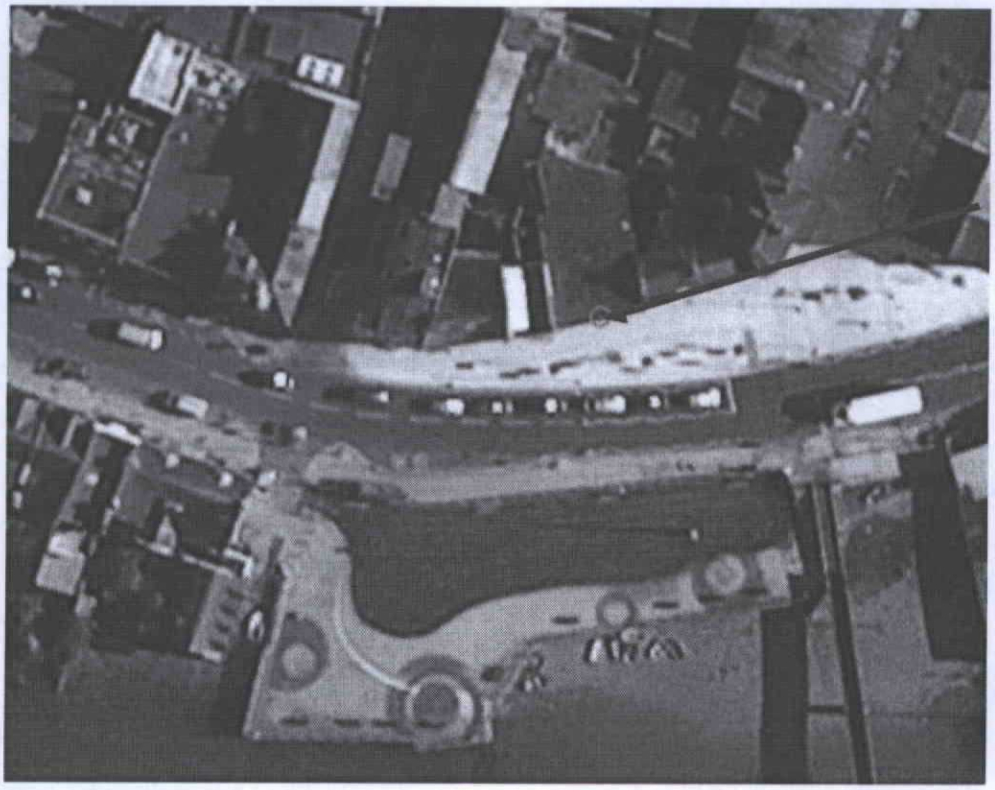


Figure 1: Noise Measurement Location

3.1 Baseline Conditions

- Survey carried out by: Simon Barrett BSc(Hons) MSc MIOA
- Equipment used: Castle "Mirus" GA117 Type 1 Logging Sound Level Meter
  Castle GA 607 Class 1 Acoustic Calibrator
  Weather Proof Microphone Housing
  Microphone Mounting Poles and Tripod
- Weather conditions: Dry*; Wind speed < 5m/s
- Meters were calibrated before and after commencing the noise measurements (@94dB no drift).

* Whilst the weather was generally dry, the daytime period of Tuesday was rainy, which affected the noise readings by 2.7dB. However, the average value for the all daytime periods is unaffected.

The survey position was 5 m above ground level at a position 11.6m from the centre line of the High Street and fixed at the first floor, 1m from the existing façade. It follows that measurements taken at this position are classed as "façade level" and therefore require a correction of -3dB to be classified as free-field.

Please note that all noise levels provided in this report will be free-field noise levels unless stated otherwise.

3.2 Road Noise Survey Results

The graph below shows the noise levels that were measured at the survey position throughout the survey period.

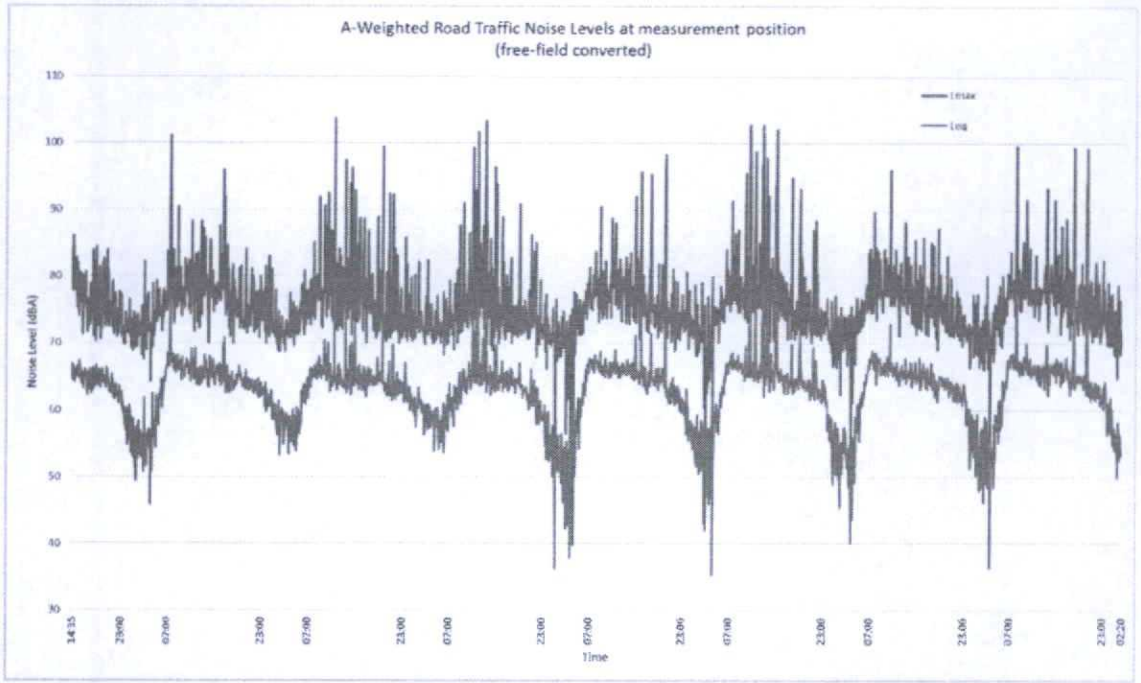


Figure 2: Measured road noise levels at survey position: free-field converted

The survey data has been used to calculate the 16hr day time and the 8hr night time period noise levels. The full tabulated survey data is available upon request if this is required.

Day	*Daytime 07:00-23:00 Leq,16hr (dBA)*	*Night time 23:00-07:00 Leq,8hr (dBA)*	*Daytime 07:00-23:00 Leq,16hr (dBA) (rounded)*	*Night time 23:00-07:00 Leq,8hr (dBA) (rounded)*
Thursday	64.67481778 *	59.91769228	65	60
Friday	66.04068816	60.43875577	66	60
Saturday	66.05377699	60.56929173	66	61
Sunday	65.6204835	58.62716483	66	59
Monday	66.00284034	59.79672983	66	60
Tuesday	68.69855058 **	59.7854892	69	60
Wednesday	65.50553322	59.57935568	66	60
Thursday	66.24544931	59.00445604 *	66	59
Mean Average	**66.10526748**	**59.71486692**	**66**	**60**

Table 2: Free-field Day & Night time Leq noise levels at measurement position (A-Weighted)

* Incomplete Period

** Wet measurement conditions

N.B. Please note that Lmax values will be investigated in section 4.2 of this report.

4 Noise Assessment

4.1 Daytime and Night Time LAeq Noise Levels

As stated in section 2 of this report, only a single façade is directly exposed to road noise, all others are surrounded by existing buildings by a direct connection.

The table below shows the average noise levels from table 2 above, in comparison with the requirements of BS8233:2014 and the attenuation required to satisfy the criteria.

The table also shows the attenuation required for the second floor flats, for which a distance attenuation calculation was first required using the formula 10*Log(r2/r1), to find the difference in noise levels between the first and second window positions.

Reception Point	Day	Night	BS8233:2014 Criteria		Attenuation Required	
	Leq,16hr	Leq,8hr	Daytime	Night time	Daytime	Night time
	dB(A) Rounded	dB(A) Rounded	Lounges / Bedrooms	Bedrooms	Lounges/ Bedrooms	Bedrooms
1st Floor	66	60	35	30	31	30
2nd Floor	65	59	35	30	30	29

Table 3: Comparison of Noise levels against BS8233 criteria

4.2 Night Time Maximum Noise Levels

BS8233 states that the Lmax noise levels at night time should not normally exceed 45dB(A) within bedrooms. Given that an open window gives attenuation of 15dB, this equates to an outside Lmax value of 60dB(A).

The table below shows the number of times the Lmax value exceed 60dB during night time hours for each period:

Night Time Period	*Number of occurrences exceeding 60dB externally*
Thursday	96
Friday	96
Saturday	96
Sunday	92
Monday	93
Tuesday	95
Wednesday	95
Thursday	41*

Table 4: Night time Lmax values exceeding 60dB just outside façade

* Incomplete period

It has been calculated against these values that a building envelope attenuation of 33dB will bring the number of these occurrences to below 10 in each period. Indeed, using the recommended glazing (see below) such occurrences would reduce to 4 or less per night.

5 Mitigation Measures

5.1 Noise Mitigation Measures Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and BS8233:2014 are as follows:

Room Type	Maximum Internal Level - Leq dB (A)
Lounges and Bedrooms	35 (Daytime only)
Bedrooms	30 (Night)
Room Type	Maximum Internal Level – Lmax dB (A)
Bedrooms	45 (not more than 10-15 times per Night)

5.2 Glazing

To provide accuracy in terms of glazing requirements, the "Rigorous Calculation Method" as detailed in BS8233 has been used, with the inclusion of the measured 1/1 Octave Band frequency spectrum. The calculations for the three different reception points have been included in the appendices of this report for completeness.

The table below shows the minimum required glazing for the development in order to satisfy the noise criteria.

	Minimum Required Glazing
1st Floor	10/12/4
2nd Floor	10/12/4

Table 5: Minimum Required Glazing for most exposed façade

N.B. Equivalent glazing of similar Rw performance values is also acceptable (Rw=36dB). The glazing specification provided above also allows for a notional 2dB reduction in performance due to framing.

5.3 Mechanical Ventilation

As stated in section 6.2 above, alternative means of ventilation would be required to enable all properties most exposed to the traffic noise to satisfy the criteria of BS8233 and WHO whilst still achieving adequate background ventilation.

It is understood that full Mechanical Ventilation Heat Recovery (MVHR) units have been stipulated by the Local Authority within planning condition 4: This type of system operates with a fresh air grill set into the external elevation, providing fresh air to the unit. The air is then ducted to one or more grills across the dwelling. Return air grills draw exhaust air back through the MVHR unit, which then discharges the air to atmosphere through a second grill in the outside wall or roof. Manufacturers do not provide sound transmission loss figures, but conservative calculations indicate that the outside to inside loss through a typical MVHR system will be in the order of 40 dB(A). This would be quite sufficient for this project, particularly if grills can be placed on the quieter side of each block. Again, manufacturers of such products include Greenwood, Passivent and Titon.

It is recommended that the intake ducts are located on the façades of the buildings least exposed to the road traffic noise, which also happen to be where the cleaner air resides. However advice should be sought from a ventilation engineer.

5.4 Outdoor Amenity Areas

As mentioned in section 2, WHO states the following with regard to outdoor amenity areas:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

BS8233:2014 however, states that it is not always possible to mitigate noise on balconies and terraces.

There are no indicated outdoor amenity areas associated with this development, therefore no consideration is required.

5.5 Sound Insulation of dormers, skeilings and ceilings and internal leaf of front façade

It is noted from the proposed plans and elevations that the top floor flats incorporate their windows within dormers. Whilst the glazing itself has been dealt with in section 6.2, it is important to note that the construction of the dormers should also provide adequate sound insulation.

Dormer cheeks, ceilings and skeilings should be lined with 2 layers of 15mm Soundbloc plasterboard. The joints should be staggered, taped and sealed with non-hardening mastic on both layers.

In terms of the front façade, it is noted that the existing construction is to be made up from slate tiles laid on 25mm x 50mm timber battens, with a breather membrane and 6mm Masterboard behind. Further to this, it is proposed that 10mm ply on 150mm x 50mm studs (incorporating Celotex and Thinsulex) is installed room side, finished with 12.5mm plasterboard.

It is recommended that the room-side plasterboard system is upgraded from 1 layer of 12.5mm plasterboard, to 2 layers of 15mm Soundbloc plasterboard, with staggered joints. They should be taped and sealed with non-hardening mastic at each layer. They should be attached to a resilient or fully independent wall lining system such as a British Gypsum Gyplyner system or independent studs. The cavity depth should be at least 50mm and incorporate at least 25mm dense mineral wool within.

6 Conclusion

Road Traffic Noise levels affecting the proposed re-development have been measured and assessed. The report shows that the only façade directly affected by road noise is the southern façade which faces Shoreham High Street.

In order to demonstrate that the noise criteria can be achieved BS8233 Rigorous calculations have been completed for various different room types and noise mitigation measures.

The report shows that with appropriate glazing and with windows closed, the noise levels can achieve the criteria of BS8233.

It is understood that the Local Authority has requested the use of MVHR units for ventilation purposes, due to air quality reasons. This will also benefit the development in terms of noise break-in, allowing background ventilation to be achieved without the need for opening windows and allowing poor quality air or high noise levels into the building.

Additionally, noise mitigation measures have been recommended in section 5 of this report and if they are implemented by the developer it is considered that the planning condition with regard to road traffic noise can be discharged.

Appendix A – BS8233 Rigorous Calculation

Non Frequency Dependent Variables		
Term	Derivation	Value
A_o	Given in BS EN 20140-10 = 10 (m^2)	10
S_f	Total Facade Area (m^2)	16.5
S_{wi}	Window Area (m^2)	3.6
S_{ew}	External Wall Area (m^2)	12.9
S_{rr}	Ceiling Area (m^2)	0.001
S	Total Area sound enters the room (m^2)	16.5

Key for Table Below	
R_{wi}	Sound Reduction of Window (Octave)
R_{ew}	Sound Reduction Index of External Wall (Octave)
R_{rr}	Sound Reduction Index of Roof/Ceiling (Octave)
A	Equivalent Absorbtion Area of Rx Room
$D_{n,e}$	Insulation of Trickle Vent (BS EN 20140-10)

Frequency Dependent Variables							
		Octave Band Centre Frequency					
Term	Description	125	250	500	1000	2000	4000
$L_{eq,ff}$	Free-Field External Noise Level	64.1	62.4	61.2	62.6	58.8	51.0
$D_{n,e}$	No Vent	100	100	100	100	100	100
R_{wi}	10_12_4	25	22	33	40	43	44
R_{ew}	Slate Tiles, 25x50mm battens, Masterboard, 150x50mm Stud with Celotex, 2x 15mm Soundbloc	33	42	49	53	52	59
R_{rr}	No Roof	100	100	100	100	100	100
A	Equivalent Absorbtion Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
	Octave Band Centre Frequency					
Term From Equation Below	125	250	500	1000	2000	4000
$L_{eq,ff}$	64.116406	62.40391	61.2249	62.64729167	58.80755208	50.9846875
$A_o/S \cdot 10^{(-D_{n,e}/10)}$	6.061E-11	6.06E-11	6.06E-11	6.06061E-11	6.06061E-11	6.06061E-11
$S_{wi}/S \cdot 10^{(-R_{wi}/10)}$	0.00069	0.001377	0.000109	2.18182E-05	1.0935E-05	8.68597E-06
$S_{ew}/S \cdot 10^{(-R_{ew}/10)}$	0.0003918	4.93E-05	9.84E-06	3.91837E-06	4.93294E-06	9.84251E-07
$S_{rr}/S \cdot 10^{(-R_{rr}/10)}$	6.061E-15	6.06E-15	6.06E-15	6.06061E-15	6.06061E-15	6.06061E-15
$10\log_{10}(S/A)+3$	4.7609126	3.713559	3.13364	3.133639616	3.413926852	3.413926852
Leq,2	39.218744	37.65855	25.12103	19.8864456	14.22669922	4.253007546
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted Leq	**23.118744**	**29.05855**	**21.92103**	**19.8864456**	**15.42669922**	**5.253007546**

A-Weigted Level Outside	66
BS8233 Predicted Internal A-Weigted Level	31
Prediced Building Envelope SRI	35

BS8233 Calculation can be seen below:

$$L_{eq,2} \approx L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Appendix B – Calibration Certificates

Calibration Certificate

Issued By: Castle Group Ltd

Date Of Issue : 25/02/14
Certificate No : 34268/60416

All instruments are tested to check compliance with particular specifications. These specifications may be appropriate British Standards, or if the instrument was not originally designed to meet any British Standard, or when the instrument was originally manufactured a relevant British Standard did not exist, the instrument will be tested to the manufacturer's original specification.

Absolute acoustic calibration of acoustic calibrators and sound level meters is checked at one or more standard frequencies against an independent sound source with calibration directly traceable to the National Physical Laboratory (NPL) in the United Kingdom. The NPL reference applicable for the calibration of the test equipment is shown below.

The performance of the instrument was determined by comparison with the manufacturers' specification as found in the instrument handbook or other technical publication. Any significant uncertainty of the measuring system will also be included.

The instrument was allowed to stabilise for a period of 30 minutes prior to measurements made.

The ambient temperature and relative humidity throughout calibration were 23 ±2 °C and 37% RH respectively.

Instruments used to carry out this calibration are as follows: -
Multifunction Calibrator 4226 Serial No: 1551589
Applicable Reference: 56312

Subject of Calibration: GA117
Instrument: Integrating 1/ 1 Octave Band Sound Level Meter
Serial No: 34268

Preamplifier Data
Preamplifier Type: SV18
Preamplifier Serial No: 33361

Microphone Data
Microphone Type: 7052E
Microphone Serial No: 55984

Basis Of Test: Compliance to IEC 61672-1 : 2002 Class 1 & IEC 61260: 1995 Class 1

Calibrated By: M. Mason *(Approved Signatory)*
Checked By: D. L. Wightson *(Approved Signatory)*

Date of Calibration: 25 Feb 2014
Recalibration Due: 01 Apr 2015

Completed Status: Pass

Client: Acoustic Associates Sussex Ltd
Address: 8 Highdown House
Shoreham Airport
Shoreham By Sea
West Sussex
BN43 5PB

Client Reference:

Castle Group Ltd
Salter Road, Scarborough Business Park, Scarborough, North Yorkshire YO11 3UZ United Kingdom
t: +44 (0)1723 584250 f: +44 (0)1723 583728 e: sales@castlegroup.co.uk
www.castlegroup.co.uk

Acoustic Associates

CERTIFICATE OF CALIBRATION

ISSUED BY: **CALIBRATION MAINTENANCE & REPAIR LTD**

DATE OF ISSUE: 11 June 2014 CERTIFICATE NUMBER: **148889**

BS EN ISO 9001:2008 APPROVED BY **LRQA**

CERT No 953910

Home Farm Industrial Park
Norwich Road
Marsham
Norfolk
NR10 5PQ
Tel: +44 1603 279557
Fax: +44 1603 278008

Page 1 of 4

Approved Signatory
Electronically Authorised Document
P.K Clark
M.A Frost
R.J Wade
M.S Pardoe [✓]

Customer	**ACOUSTIC ASSOCIATES SUSSEX LTD**
Order No	**118B**
Equipment Description	**ACOUSTIC CALIBRATOR**
Manufacturer	**CASTLE GROUP LTD**
Model	**GA607**
Serial No	**040430**
Ident No	**NOT KNOWN**
Date Of Calibration	**11 JUNE 2014**

INSTRUMENT CONDITION

Adjustments Made	**NO**
Repairs Made	**NO**

ENVIRONMENT

The instrument was placed in the laboratory environment for a minimum period of 4 hours and was operated prior to calibration.

Measurements were made in ambient conditions of 22°C ± 3°C and 45% ± 15% RH.

STABILITY

The results attached to this certificate refer to measurements made at the time of test and not to the instrument's ability to maintain calibration.
All reference instruments are traceable to recognised National Standards.
The attached results are a true record of the levels required to return the instrument to the original stated manufacturer's specification and accuracy where known.