P1652/L10/Rev C/SJF

14 May 2020

Ms Alba Menéndez Pardo
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Dear Alba,

Kidderpore Avenue
Revised Kidderpore Hall Condenser Installation, Acoustic Impact Assessment

Following our various correspondence, please now find details of our summary acoustic assessment of the proposed 1 no. Toshiba type MMY-MAP1606HT8P-E unit, to be externally sited within bespoke, full Environ acoustic enclosure unit as shown on A&Q Architects drawings.

1. Basic Details of Proposed Installation

The minimum distance between the proposed, fully acoustically enclosed condenser unit and any noise sensitive flat façade is 4 metres, and the maximum resultant condenser noise level, at source (within the bespoke acoustic enclosure) shall be 39dB(A) as measured at a distance of 1 metre from any acoustic enclosure surface. The complete acoustic enclosure is partially screened by the proposed sunken, walled condenser compound installation.

2. Applicable Planning Conditions Relating to Noise

The assessment presented in this letter has been prepared to support a separate application for planning permission and listed building consent. However, in order to inform this assessment, the requirements of Planning Conditions pertinent to noise which have been stipulated in previous planning consents for this Development have been considered. Condition 39 and 40 of Planning Consent 2018/6347/P relate to environmental noise as arising from M&E plant, as follows:

'… 39. Prior to occupation of the hereby approved unit within Kidderpore Hall, the condenser units shall be provided with acoustic isolation and anti-vibration measures as shown on 9000-DRG-03KH-UG010 Rev C7 and referenced in Acoustics Kidderpore Hall Condensers by Sol Acoustics dated 03/12/18. All such measures shall thereafter be retained and maintained in accordance with the manufacturers' recommendations.

Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policies A1 and A4 of the London Borough of Camden Local Plan 2017.

40. Prior to the commencement of works relating to the condenser units to Kidderpore Hall, full details of the acoustic enclosure and anti-vibration mount shall be submitted to and approved in writing by the Local Planning Authority. The approved details shall thereafter be retained and maintained in accordance with the manufacturers' recommendations.

Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policy G1, A1, A4, D1 and CC1 of the London Borough of Camden Local Plan 2017. …'

In terms of full details of the proposed installation, please refer to A&Q Architects drawings and specifications forming part of this Submission.

In terms of the environmental noise impact of the proposed, revised condenser scheme, full 3D noise models of the complete installation and nearest Kidderpore Hall building façades have been compiled by Sol Acoustics, as utilizing CadnaA proprietary 3D noise modelling software, in order that the resultant, predicted condenser noise levels as arising at Kidderpore Hall façades may be compared to typical, measured, pre-existing night time background noise levels at the same location, for BS4142: 2014 noise assessment purposes. Full details are provided herein.

In terms of the vibration isolation of the condenser unit, this shall be fitted with OEM-supplied rubber vibration isolators/pads, such that problematic vibration and/or structure borne noise transmission arising from the condenser unit and its operation, to any residential premises, does not occur.

3. 3D CadnaA Environmental Noise Model of Worst Case Condenser Operation

Figure 1 below shows the CadnaA 3D environmental noise model output for the proposed condenser operation, as operating at full inverter speed, and the resultant, worst case, at façade Kidderpore Hall noise level of 26dB L_{Aeq} (ignoring any night time set back speed of condenser unit):

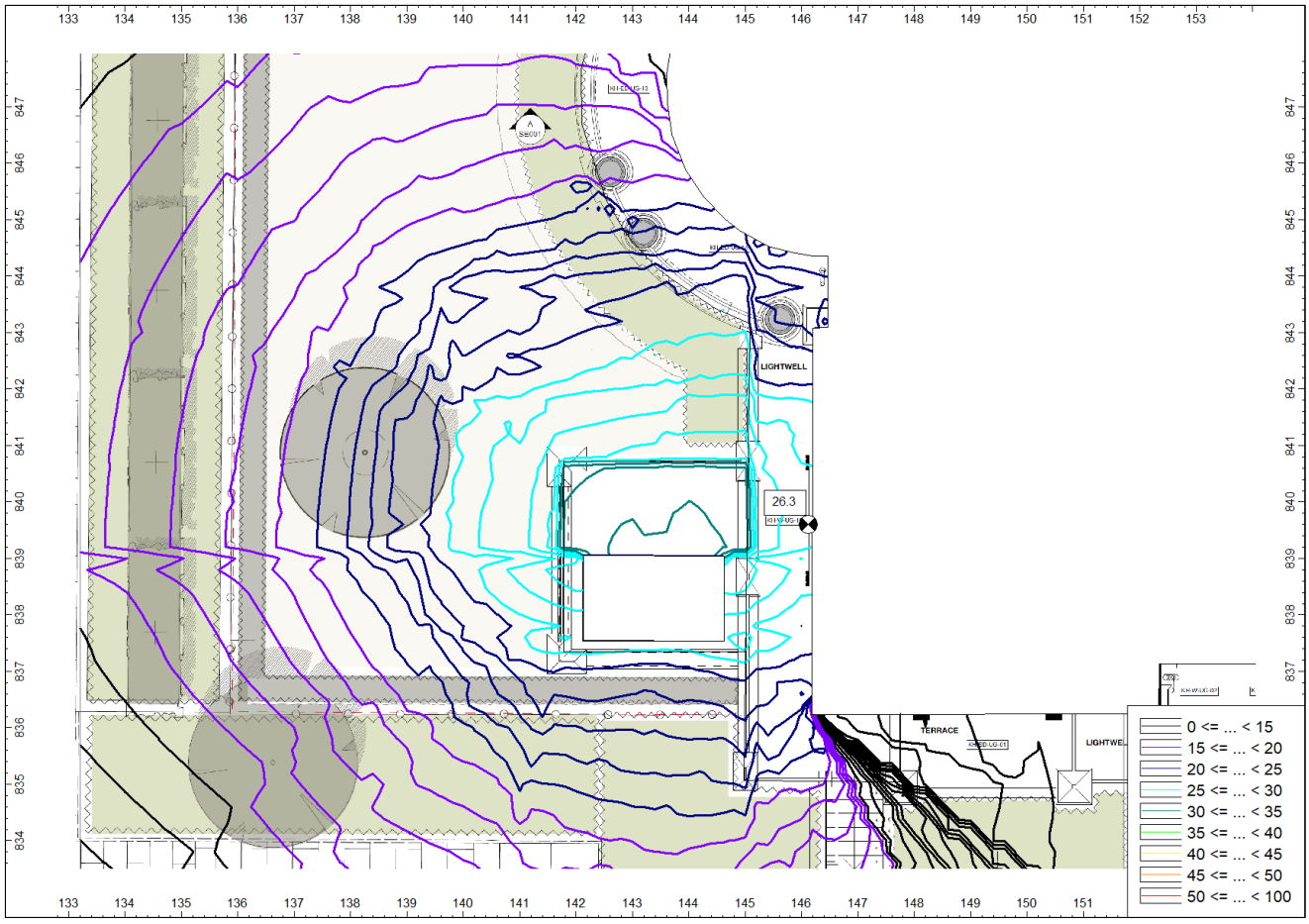


Figure 1: CadnaA 3D noise model map of proposed condenser unit and adjoining Kidderpore Hall façade

4. Summary BS4142: 2014 Assessment

The typical *night time* background noise climate is c.40dB L_{A90}, as per Sol Acoustics' report ref. P1652-REP01-SJF dated 27 October 2015, for Kidderpore Hall façade). It will be appreciated that where the worst case, total anticipated Specific Noise Level for the condenser units is 14dB below typical night time Background Sound Level, then in BS4142: 2014 assessment terms this represents a positive indication of no adverse impact due to noise.

Whilst this assessment is based upon environmental noise level measurements as conducted by Sol in 2015, it is considered highly unlikely that the results of a more recent environmental noise survey conducted at the site would suggest a significant change in the observed typical night time Background Sound Level such that it would alter the findings of the assessment, given that the predicted Specific Sound Level is 14dB below the as measured 2015 Background Sound Level.

In conclusion, therefore, it is the case that the current proposed acoustic mitigation to the proposed condenser unit, comprising of full bespoke Environ acoustic enclosure, vibration isolation pads, should be regarded as acoustically acceptable.

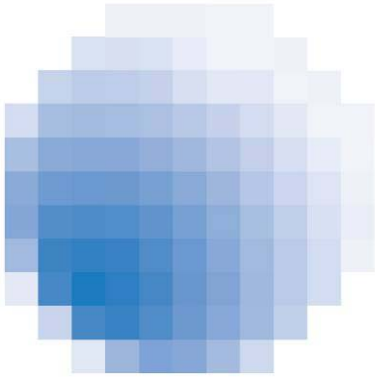
I trust that the above and attached information will be of assistance, and we now await further instructions from Mount Anvil in respect of this matter.

Yours sincerely
For and on behalf of Sol Acoustics Limited

SIMON FERENCZI MIOA
Managing Director

APPENDIX

Sol Acoustics Report P1652-REP01-SJF Dated 27 October 2015



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Mount Anvil Limited

Kidderpore Avenue, London

Environmental and Intrusive Noise Study

27 October 2015

PROJECT:	Kidderpore Avenue, London Environmental and Intrusive Noise Study
CLIENT:	Mount Anvil Limited 140 Aldersgate Street London
DOCUMENT REFERENCE:	P1652-REP01-SJF
SIGNED:	_____ SIMON FERENCZI
CHECKED:	_____ DARREN CLUCAS
DATE:	27 October 2015

CONTENTS

SUMMARY

Sol Acoustics Ltd (Sol) has been commissioned by Mount Anvil Limited (MA) to conduct an environmental and intrusive noise assessment relating to the proposed Kidderpore Avenue residential development site located in Hampstead, London.

The purpose of the report is to determine an appropriate acoustic performance specification for glazing (assuming a whole house vent system or continuous mechanical extract trickle vent system), together with the building envelope, all as based on the pre-existing site environmental noise climate, the prescribed intrusive noise requirements and currently available building design details for both new build and refurbishment buildings.

In addition, the maximum allowable daytime and night time environmental noise contribution from M&E plant has also been determined.

Full details are provided within the report, including acoustic performance specifications and suggested configurations for all glazing and external building envelope construction for habitable rooms.

1.0 INTRODUCTION

Sol Acoustics Ltd (Sol) has been commissioned by Mount Anvil Limited (MA) to conduct an environmental and intrusive noise assessment relating to the proposed Kidderpore Avenue residential development site located in Hampstead, London.

The purpose of the report is to determine an appropriate acoustic performance specification for glazing (assuming a whole house vent system or continuous mechanical extract trickle vent system), together with the building envelope, all as based on the pre-existing site environmental noise climate, the prescribed intrusive noise requirements and currently available building design details for both new build and refurbishment buildings.

In addition, the maximum allowable daytime and night time environmental noise contribution from M&E plant has also been determined.

Full details are provided within the report, including acoustic performance specifications and suggested configurations for all glazing and external building envelope construction for habitable rooms.

2.0 DESCRIPTION OF DEVELOPMENT AND SITE

2.1 Description of Development

The proposed Kidderpore Avenue residential development on Kidderpore Avenue, Hampstead will provide up to 156 residential dwellings by way of the conversion and refurbishment of four statutorily listed buildings, Kidderpore Hall, Maynard Hall, Skeel Library and The Chapel; the conversion and extension of three other buildings, Bay House, Dudin Brown Hall and Lady Chapman Hall; the demolition of three non-listed buildings, and their replacement with three new buildings (Lord Cameron Hall, Rosalind Franklin Hall and Queen Mother's Hall).

The relocation and restoration of one statutorily listed building within the site, The Summerhouse, will also be undertaken, along with associated residents' facilities, various hard and soft landscaping works including the removal of trees, and the construction of a double storey basement including car and cycle parking and plant.

2.2 Description of Site

The application site is sited on the northern side of Kidderpore Avenue, London, NW3; the extent of the application site is as shown on Figure 1. The site extends to approximately 1.22 hectares and there are eleven buildings or structures on the site, of which five are on the national list of buildings of special architectural or historic interest.

The south-eastern side of the site is bounded by Croft Way, a public footpath, and the entire length of the south-western side of the site is bounded by Kidderpore Avenue, a public highway. The latter is a relatively busy carriageway during both daytime and early morning periods.

The entire length of the north-western side of the site is bounded by St Luke's Vicarage, St Luke's Primary School and land associated with these; including a school outdoor play area.

The north-eastern boundary of the site is bounded by three parcels of land which are currently in use as two separate tennis clubs, which are situated either site of a covered reservoir.

Pre-existing residential buildings are sited on the opposite side of Kidderpore Avenue, including the "Westfield" residential development and the adjacent site which is currently being developed by Barratt Homes for residential accommodation and community use.

Figure 1: Pre-development site location plan

3.0 DETAILS OF INVESTIGATION

In order to determine the prevailing environmental noise levels around the development site, surveys of the pre-existing noise climate have been carried out over typical weekdays, during daytime, evening and night time periods.

Specifically, noise surveys were undertaken at the Kidderpore Avenue residential development site during the following periods, with no site construction activities being undertaken:

- Wednesday 14th October 2015 (16:20 hours to 23:59 hours)
- Thursday 15th October 2015 (00:00 hours to 20:00 hours)

External noise measurements were made at a height of approximately 3 metres from corresponding ground level per measurement position. All the measuring locations were in so-called “free field” conditions, in acoustic terms (i.e. free from nearby reflective surfaces except the ground), and thus no correction has been applied to the noise survey data directly obtained, in any instance.

Internal room noise measurements were also made during daytime and/or overnight periods within Kidderpore House (Kidderpore Avenue and west-facing façades), Skeel House and Bay House (Kidderpore Avenue façades). All rooms were unfurnished.

All noise measurements were undertaken using continuous logged measurement durations of 5 minutes during daytime periods and 1 minute during night time periods, with L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} parameters being recorded, together with unweighted octave band L_{eq}, L_{max}, L_{10} and L_{90}.

The prevailing weather conditions were suitable for the purposes of environmental noise measurements throughout the various noise surveys. No rain occurred at any time and mean wind velocities were below 5m/s, albeit microphone windshields were in use at all times.

Figure 2 shows the approximate location of all external noise monitoring points; the various site monitoring locations were selected to coincide with existing and future building façades.

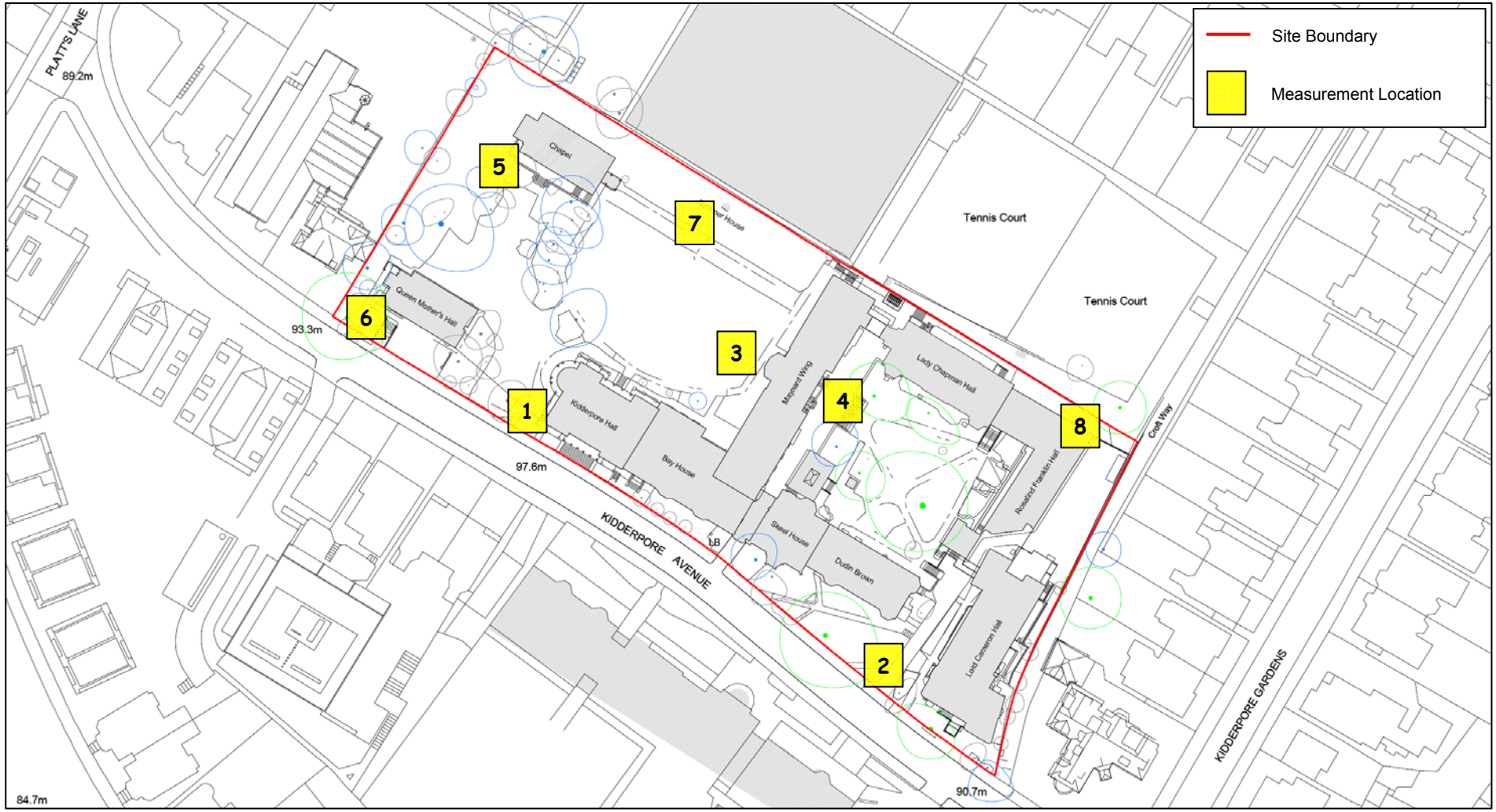


Figure 2: External noise survey measurement positions

4.0 SUMMARY OF MEASURED NOISE DATA

4.1 External Noise Measurements

Table 1 provides a basic summary of the typical overall, A-weighted noise levels measured at the various external locations around the Kidderpore Avenue site, in L_{Aeq}, L_{A90} and L_{Amax} terms:

	Measured Noise Level (Average L_{Aeq}, Range L_{A90} & L_{Amax})					
	Daytime			**Night Time**		
Position	**dB, L_{Aeq}**	**dB, L_{Amax}**	**dB L_{A90}**	**dB, L_{Aeq}**	**dB, L_{Amax}**	**dB L_{A90}**
1	55	56 to 75	42 to 54	49	43 to 75	36 to 53
2	54	51 to 75	42 to 49	47	42 to 71	40 to 47
3*	52	52 to 72	44 to 50	n/a	n/a	n/a
4*	52	56 to 74	37 to 41	n/a	n/a	n/a
5*	47	51 to 66	41 to 43	n/a	n/a	n/a
6	57	64 to 77	49 to 53	49	47 to 73	36 to 46
7*	n/a	n/a	n/a	39	39 to 51	36 to 40
8	51	50 to 81	40 to 49	n/a	n/a	n/a
**short term measurements for comparative purposes only*						

Table 1: Summary of typical, measured environmental noise levels, in broadband terms

Tables 2 and 3 summarise the corresponding typical unweighted octave band noise spectra, for daytime and night time periods respectively, in time-averaged L_{eq} terms:

		Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
Measurement Location	**Noise Level, dB L_{Aeq}**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**
1	55	63	56	54	52	52	47	40
2	54	60	54	52	50	50	45	39
3	52	62	53	51	50	48	40	29
4	52	54	53	52	51	48	40	32
5	47	55	49	47	46	43	36	29
6	57	62	58	55	54	53	49	41
7	n/a	-	-	-	-	-	-	-
8	51	56	51	48	47	47	43	39

Table 2: Summary of daytime, time-averaged environmental noise levels, octave band terms

		Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
Measurement Location	**Noise Level, dB L_{Aeq}**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**
1	49	55	48	47	45	46	41	33
2	47	52	49	46	43	42	37	37
3	n/a	-	-	-	-	-	-	-
4	n/a	-	-	-	-	-	-	-
5	n/a	-	-	-	-	-	-	-
6	49	57	50	45	44	46	41	32
7	39	50	42	35	37	36	28	21
8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 3: Summary of night time, time-averaged environmental noise levels, octave band terms

Appendix A provides further information.

4.2 Description of Pre-Existing Noise Climate

Traffic noise arising from Kidderpore Avenue is the primary noise source; this is a relatively busy carriageway during both daytime and early morning periods as regards to intrusive noise.

As previously noted, the north-western perimeter of the site is bounded by St Luke's Vicarage and St Luke's Primary School, with associated outdoor play area. The play area was in use during several periods during the daytime noise surveys undertaken and noise arising from school children playing, shouting etc. was noted (and recorded) at the affected noise monitoring positions.

The north-eastern site perimeter is bounded by three parcels of land which are currently in use as two separate tennis clubs located either site of a covered reservoir. There were in use during the daytime noise survey periods (and a corresponding uplift in measured noise levels between 14:00 hours and 15:00 hours was noted, recorded and taken account of in all intrusive noise calculations; please refer to Appendix A, Graph A12 for further information).

Distant traffic noise from Finchley Road, was also present during much of the daytime and nigh time noise survey periods.

4.3 Internal Noise Measurements within Existing Buildings

In order to ascertain the acoustic performance of the external envelopes of existing buildings which are to be retained and refurbished, internal noise measurements were undertaken within select locations, predominately within areas of the buildings on the noisiest façades facing Kidderpore Avenue.

Table 4 provides a basic summary of the typical overall, A-weighted noise levels measured at the various internal room locations within the existing buildings (with windows fully closed in all cases), in overall (L_{Aeq}) and maxima (L_{Amax}) terms:

	Measured Noise Level (Average L_{Aeq}, Range L_{Amax})			
	Daytime		**Night time**	
Position	**dB, L_{Aeq}**	**dB, L_{Amax}**	**dB, L_{Aeq}**	**dB, L_{Amax}** (exceedences over 45dB L_{Amax})
A* Kidderpore House (Kidderpore Avenue façade)	32	41 to 53	-	-
B* Kidderpore House (west façade)	33	32 to 56	-	-
C* Skeel House first floor (Kidderpore Avenue façade)	35	37 to 53	-	-
D Skeel House ground floor (Kidderpore Avenue façade)	-	-	22	20 to 47 *7 exceedences over 45dB L_{Amax}*
E* Bay House (Kidderpore Avenue façade)	32	41 to 53	-	-
**short term measurements for comparative purposes only*				

Table 4: Summary of typical, internal noise levels, in broadband terms

It shall be noted from Table 4 that the internal, intrusive noise levels measured within the selected retained building areas are within the design requirements of BS8233: 2014. Therefore, it is expected that the current installed glazing, which is to be retained (assumed to comprise of at least 6mm thick single glazing, fully made good and sealing with no gaps etc.), should provide adequate acoustic performance in terms of intrusive noise ingress, once all the glazing systems have been refurbished (NB: subject to ventilation provisions, which must be acoustically assessed by Sol).

Position C, Skeel House first floor, was noted as having gaps etc. within window frames; as per above it is assumed all shall be rectified and made good upon refurbishment and finalisation of the scheme, prior to any occupation.

It is understood that the majority of the retained single glazing shall be provided with additional secondary glazing in order to improve the thermal performance of the glazing systems. This is expected to improve the acoustic performance of the existing glazing still further, albeit the precise, proposed extent and configurations of all glazing, whether newly provided or retained (including secondary glazing), must be fully evaluated by Sol prior to any finalisation.

Appendix A provides further information, including noise time-history graphs for various internal and external noise measurement data obtained.

5.0 INTRUSIVE NOISE CONTROL TO HABITABLE ROOMS

5.1 Basis of Acoustic Design

In the absence of any specific, Conditioned requirements or advised Employers' Requirements as regards intrusive noise limits within new build and refurbished elements of the scheme, this report provides acoustic advice for the attainment of intrusive noise standards as defined by BS8233:2014 *'Guidance on sound insulation and noise reduction for buildings'* – as duplicated by Table 5 below:

BS8233: 2014 – Indoor ambient noise levels for dwellings			
Activity	**Location**	**07:00 to 23:00**	**23:00 to 07:00**
Resting	Living room	35dB $L_{Aeq,\ 16\ hours}$	-
Dining	Dining room / area	40dB $L_{Aeq,\ 16\ hours}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,\ 16\ hours}$	30dB $L_{Aeq,\ 16\ hours}$

Table 5: Adopted intrusive noise design criteria

Therefore the maximum recommended *daytime* intrusive noise level within living rooms forming part of the development is 35dB $L_{Aeq(16\ hours)}$, and the corresponding *night time* intrusive noise limit within bedrooms is 30dB $L_{Aeq(8\ hours)}$.

Additionally, it is recommended that *daytime* intrusive noise level within bedrooms forming part of the development should be 35dB to 40dB $L_{Aeq(16\ hours)}$.

No specific performance recommendation is given within BS8233: 2014 with regard to maximum intrusive noise levels within bedrooms. In the absence of a performance criterion, reference can be made to guidance published by WHO.

The WHO publication 'Guidelines for Community Noise' (1999), from which the guidance given in BS8233: 2014 is itself derived, states that *'for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than ten to fifteen times per night'.* Thus, the acoustic design advice provided herein is also compliant with this night time bedroom noise maxima requirement.

By taking account of the actual levels of ambient noise specifically measured at the future site façade locations, the proposed areas of façade elements and their intended constructions (i.e. glazing and walls), as well as the likely acoustic characteristics of the noise sensitive receiving space (i.e. living rooms, bedrooms), the sound reduction properties need from each of the various building façade elements have been determined through acoustic calculation.

The window areas, room dimensions and site layout used in all our calculations are all as shown by Scott Brownrigg Architects “Planning Package” drawings provided to Sol during October 2015. If there are any subsequent changes to any the proposed glazing areas and/or room layouts and floor plans, for any habitable room(s), these must be evaluated acoustically.

At the time of reporting, the required ventilation strategy for the development (i.e. trickle ventilators or fan-powered whole house ventilation) has not been formally determined and/or advised to Sol; this information is awaited and will require specific acoustic review and input from Sol. This will have a bearing on the acoustic performance requirements of the building elements, depending on which system is used.

Acoustic advice is provided for both Whole House Vent (MVHR) and Continuous Mechanical Extract (MEV) system with trickle vent scenarios.

If there are any subsequent changes to any of the proposed glazing areas and/or room layouts and floor plans, for any habitable room(s), or to the ventilation strategy to be adopted, these must be evaluated acoustically.

5.2 Glazing System Acoustic Requirements

All glazing specifications for habitable rooms must have at least the minimum acoustic performance specifications indicated by Table 6, all as confirmed and corroborated by independent acoustic laboratory test data for identical constructions, for *complete* window systems (i.e. including frame as well as glazing cores; applicable to glazed doors also).

It is assumed that where MVHR is to be used, no trickle vents will be required. Where MEV is to be used, the provision of a trickle ventilator of Equivalent Area no greater than 2500mm^2 has been assumed by all acoustic design calculations, and this must not be exceeded in any instance. Table 8 provides acoustic specification details for trickle ventilators.

In all cases, glazing and glazed door acoustic requirements (and trickle vent acoustic requirements where used) have been prescribed according to which "Zone" (i.e. building façade/elevation) is being considered. These Zones are as shown by Figure 3, and referred to within Table 6 *et al.*

Thermal cavities must be specified by others, albeit these must not impinge upon the minimum required acoustic performance specification requirements.

It is understood that in the case of the existing buildings, the glazing and frames are to be refurbished and rendered gap-free. Also, in the majority of cases, additional secondary glazing systems will be installed, in order to improve the thermal performance of the existing windows/glazing systems. It is expected that these secondary glazing systems will improve the existing performance of the installed, assumed 4mm standard glazing.

It is imperative that all existing window frames are refurbished to ensure that no gaps or holes present that will compromise the acoustic performance of these units.

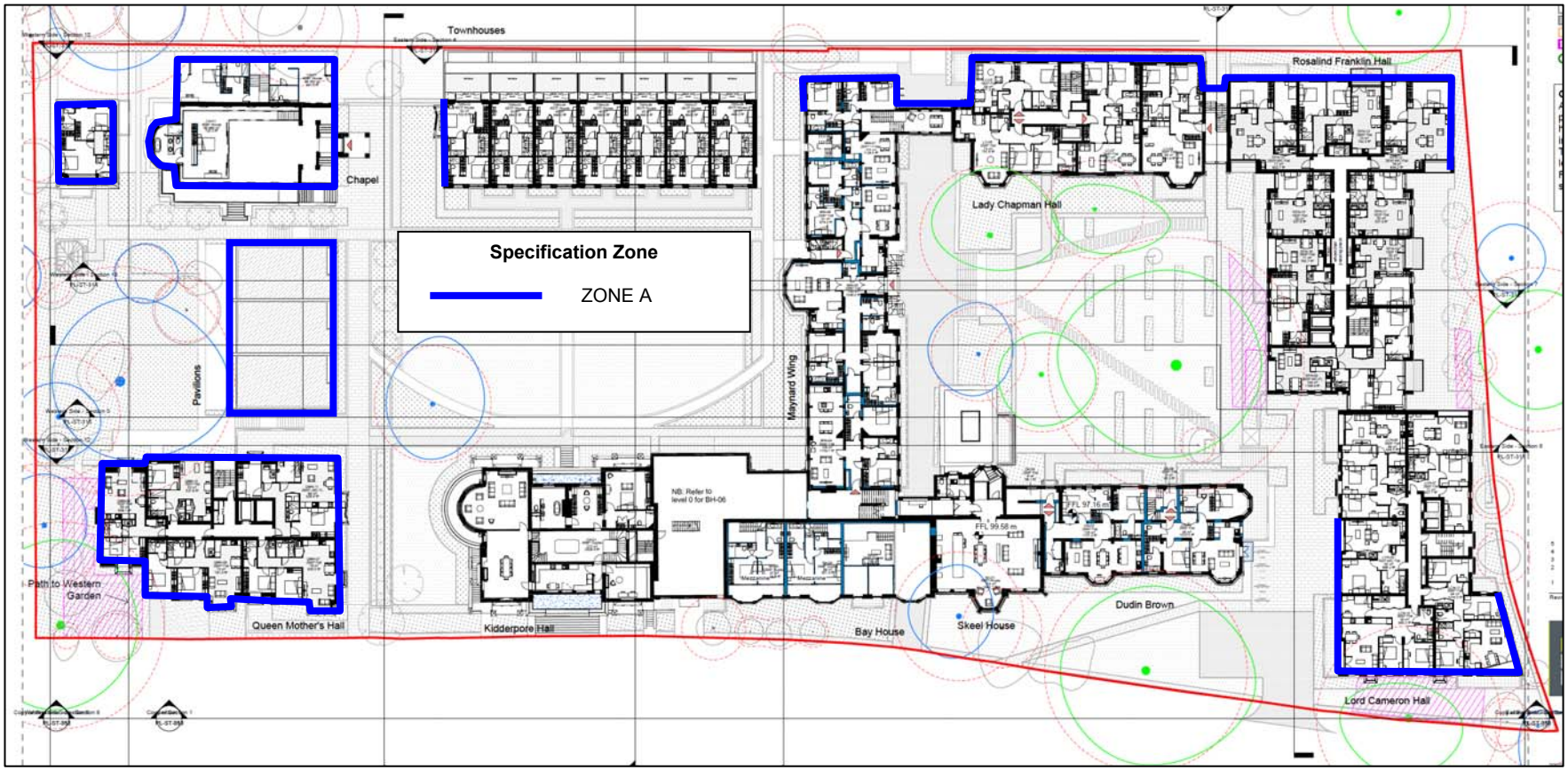


Figure 3: Glazing and trickle vent zones per façade

<table>
<tr><td rowspan="3">Zone</td><td colspan="2">WHOLE HOUSE VENT (MVHR)</td><td colspan="2">CONTINUOUS EXTRACT (MEV)</td></tr>
<tr><td>Bedrooms</td><td>Living Rooms / Dining Rooms</td><td colspan="2">Bedrooms / Living Rooms / Dining Rooms</td></tr>
<tr><td colspan="2">Glazing Spec †
(mm)</td><td>Glazing Spec †
(mm)</td><td>Trickle Vent</td></tr>
<tr><td>A</td><td colspan="2"><u>New Build</u>
Glazing Type 1
(e.g. 4/12/6)

<u>Refurbishment</u>
Glazing Type 3
(assumed existing 6mm pane, single glazed)</td><td><u>New Build</u>
Glazing Type 1
(e.g. 4/12/6)

<u>Refurbishment</u>
Glazing Type 3
(assumed existing 6mm pane, single glazed)</td><td><u>New Build</u>
Trickle Vent Type 2

<u>Refurbishment</u>
Trickle Vent Type 1</td></tr>
<tr><td>All other façades</td><td colspan="2"><u>New Build</u>
Glazing Type 2
(e.g. 4/16/4)

<u>Refurbishment</u>
Glazing Type 3
(assumed existing 6mm pane, single glazed)</td><td><u>New Build</u>
Glazing Type 2
(e.g. 4/16/4)

<u>Refurbishment</u>
Glazing Type 3
(assumed existing 6mm pane, single glazed)</td><td>Trickle Vent Type 2</td></tr>
<tr><td colspan="5">† Glazing configurations are shown for guidance purposes only. The overriding requirement is that the glazing achieves at least the minimum sound reduction indices, per glazing configuration type, at each octave frequency band, as provided by Table 7.</td></tr>
</table>

Table 6: Glazing and trickle vent acoustic recommendations – per zone

Table 7 identifies the minimum recommended acoustic performance requirements (in Sound Reduction Index terms) of the various windows and glazing configurations (including glazed doors).

The minimum glazing sound insulation performance requirements cited in this table relate to the *complete, framed window (and glazed door) units,* in all cases, namely glazing, the window frames and seals, together with the cavity closer between the frames and the structural opening, all as corroborated via independent acoustic laboratory test data:

Glazing Configuration	**Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)**						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Glazing Type 1 (e.g. 4mm/12mm/6mm)	19	23	23	30	41	41	39
Glazing Type 2 (e.g. 4mm/16mm/4mm)	19	24	20	25	35	38	35
Glazing Type 3 (c.6mm single glazed minimum – existing to be refurbished)	16	20	22	28	33	34	28

Table 7: Minimum recommended sound reduction index of glazing (incl. glazed doors)

Where used, all trickle ventilator types and specifications cited herein must achieve at least the minimum acoustic performance specification performances as indicated by Table 8:

Trickle Vent Specification	**Minimum Element-Normalised Level Difference - $D_{n,e}$ (dB) @ Octave Band Centre Frequency (Hz)**						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
Trickle Vent Type 1	28	28	31	34	33	35	35
Trickle Vent Type 2	28	28	31	31	29	34	34

Table 8: Minimum required sound reduction index of trickle vents

Table 8 shows the minimum required element-normalised level difference ($D_{n,e}$) for the *installed free area* of trickle vent, per room, where trickle vent is to be deployed. It must be noted that the acoustic performance stated by manufacturers for various trickle vents will be related to the free area of the vent that has been acoustically tested in a laboratory. If a greater free area of vent is to be installed than that actually tested, this must be taken account of when selecting trickle ventilator types and their required sizes.

Please note that the above specifications assume *one* trickle ventilator will be utilised per room, and that a continuous mechanical extract system will be utilised in all cases. The indicated trickle vent acoustic specifications should be increased by a factor of 10*Log(N) should N ventilators be required per room, i.e. increase by +3dB or +5dB respectively should two or three ventilators be required per room.

5.3 Maximum Allowable MVHR and MEV System Room Noise Levels

In terms of internal room noise levels arising due to the operation of MVHR and/or MEV units (and/or any other proposed ventilation plant within any flats), the following room noise levels *must not* be exceeded in any instance, for any required operating condition:

- NR25 in the case of any bedroom
- NR30 in the case of any living room

The above requirements must be forwarded to the M&E Engineer and M&E Contractor (and incorporated into the M&E Specification, plant schedules and all Tender and Contract documentation).

In practical terms, this will mean all MVHR and/or MEV units must be appropriately selected and sized to operate only at low fan speeds and furthermore, proprietary in line duct attenuators must be fitted (as provided by the MVHR manufacturer).

5.4 New Buildings, Envelope Acoustic Requirements

The following external wall constructional specification has been assumed in all cases in acoustic terms:

External Wall - Brick Outer

- At least one brick wall leaf
- Thermal insulation and cavity
- Plaster /dry-lining

The following assumed roof construction specification has been used and assumed in all instances, in acoustic terms:

Roof

- Clay roof tiles
- Mineral wool insulation
- 12.5mm plasterboard ceiling

The expected sound reduction indices of the external wall and roof and ceiling constructions are as follows, in all cases:

Wall Construction Type	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Brick Outer	36	41	45	45	54	58	58
Roof and ceiling combined	19	24	34	40	45	49	49

Table 9: Minimum building envelope acoustic performance requirements

6.0 ENVIRONMENTAL NOISE LIMITS FOR M&E PLANT

The following draft Planning Condition as regards noise limits for M&E plant has been provided to Sol:

…"*Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (LA90), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive facade shall be at least 10dB(A) below the LA90, expressed in dB(A).*"…

Accordingly, with reference to the above draft Planning Condition and BS4142 *et al*, it is normal practice to limit the total, aggregate environmental noise from all M&E plant, when operating simultaneously, to an ambient noise level (in $L_{Aeq,T}$ terms) equating to the lowest, pre-existing daytime or night time background noise level at any residential property façade, in L_{A90} terms, less a further 10dB.

Plant and equipment that has distinguishable noise characteristic(s) should be avoided (such as a whine, hiss, screech, hum and/or if there are distinct impulses, bangs, clicks, clatters or thumps etc.).

In terms of plant noise limits, the lowest recorded daytime and night time background noise levels at the proposed development façades were 37dB L_{A90} in the day (for Position 4) and 36dB L_{A90} at night (for Positions 1, 6 and 7).

Thus, in order to sufficiently control the environmental noise impact of all M&E plant associated with this development, all such mechanical services plant should be selected and suitably attenuated so as to limit the environmental noise at any residential property facades to the following daytime and night time limits:

Location	**Maximum Building Services Plant Noise Level dB L_{Aeq}**	
Any residential façade within (or adjacent to) the proposed development	**Daytime (07:00hrs to 23:00hrs)**	**Night time (23:00hrs to 07:00hrs)**
	<30	<30

Table 10: Environmental noise limits for M&E plant

The above maximum allowable daytime and night time M&E plant environmental noise level limits must be forwarded to the M&E Engineer to allow selection of suitable plant and any required noise mitigation measures, such as attenuators, when full details of the entire proposed M&E scheme are known (including that which is to serve any commercial areas).

It must be noted that the M&E plant noise limits identified above are applicable to *all* such plant and louvres etc., serving *all* areas of the development, when operating simultaneously. The allowable *individual* contribution from all plant items and atmospheric terminations such as louvres and cowls must be determined and based on these *overall* noise limits, and will thus be individually lower so as to allow for cumulative effects.

APPENDIX A
NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Kidderpore Avenue, Hampstead, London

DATES AND TIMES

Wednesday 14th October 2015 – 20:00 hours to 23:59 hours
Thursday 15th October 2015 – 00:00 hours to 20:00 hours

PERSONNEL PRESENT DURING MEASUREMENTS

Darren Clucas – Sol

INSTRUMENTATION

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 28260)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 29917)

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 28957)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 31041)

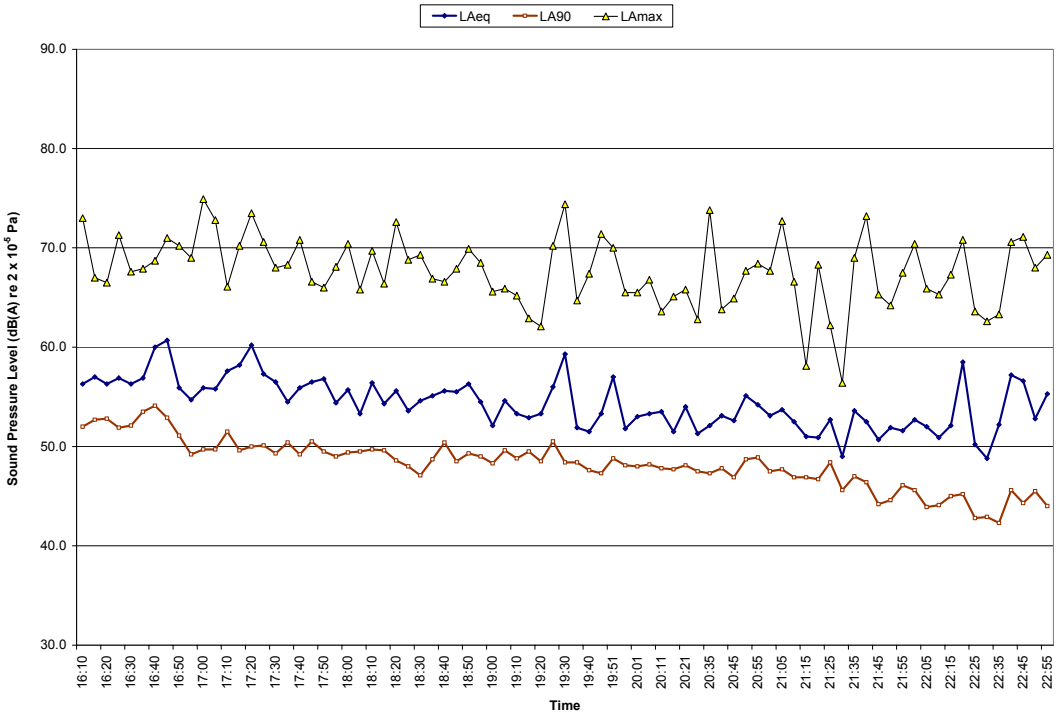
Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 31498)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 31971)

METHODOLOGY

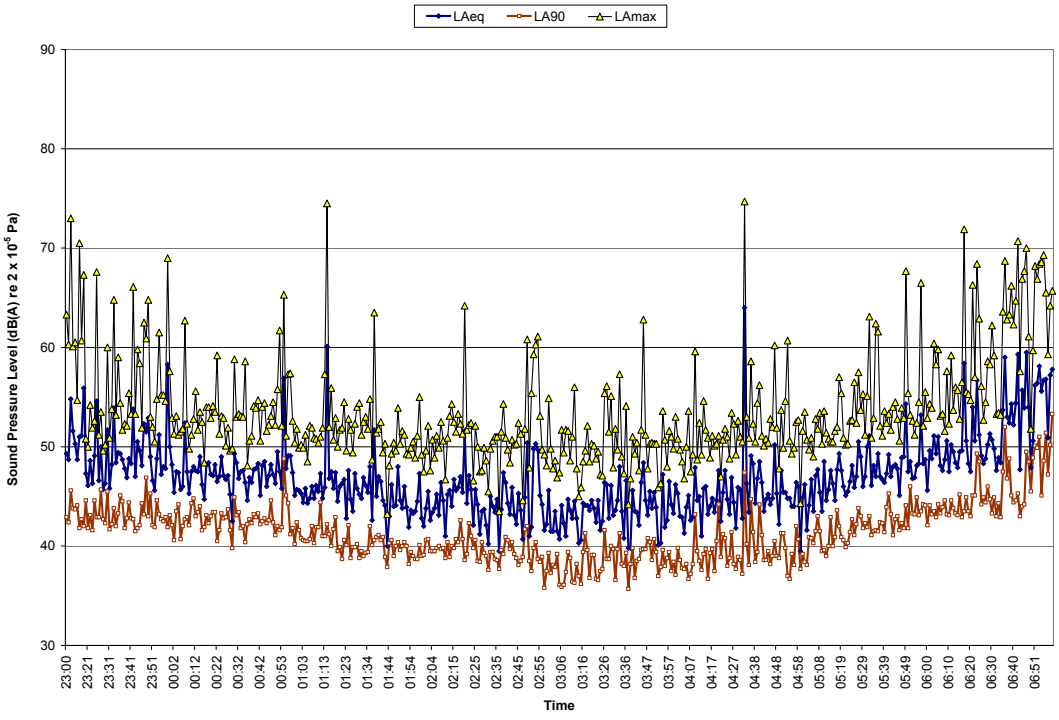
Before and after the measurements the Norsonic Type 118 was check calibrated to an accuracy of ±0.3dB using the Norsonic Type 1251 Calibrator. The calibrator produces a sound pressure level of 114 dB re $2x10^{-5}$ Pa @ 1kHz.

MEASUREMENT RESULTS

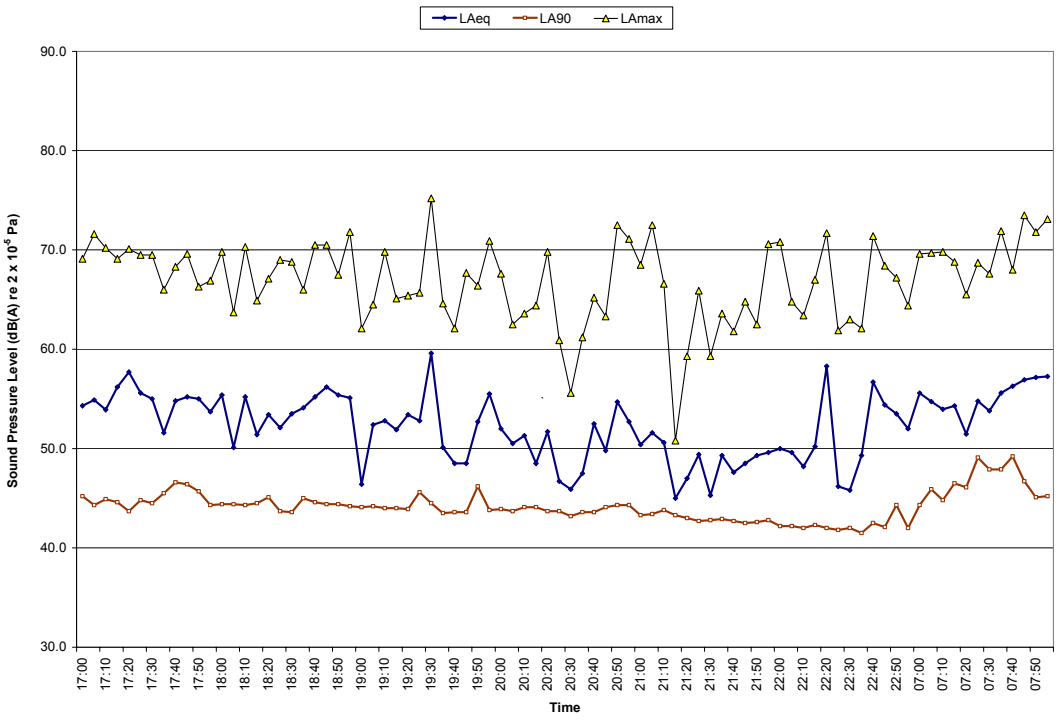
Graphs A1 to A12 summarise the results obtained from the external noise surveys.
Graphs A13 to A17 summarise the results obtained from the internal noise intrusion surveys.



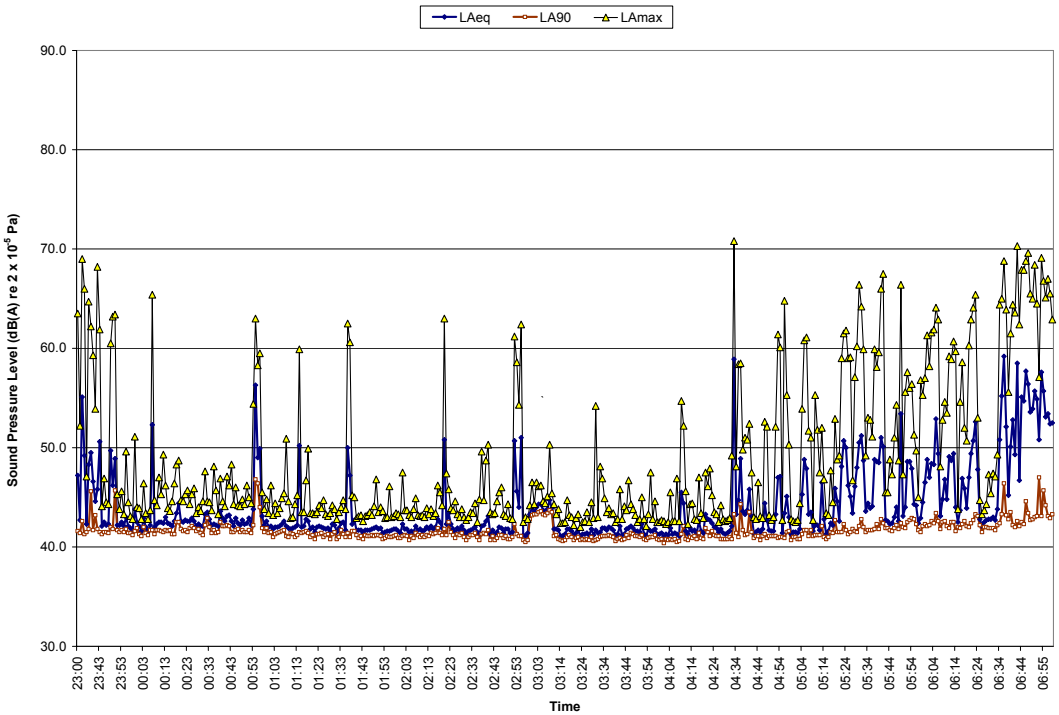
Graph A1: Summary Statistical Noise Levels – Position 1 - Daytime, 14th October 2015



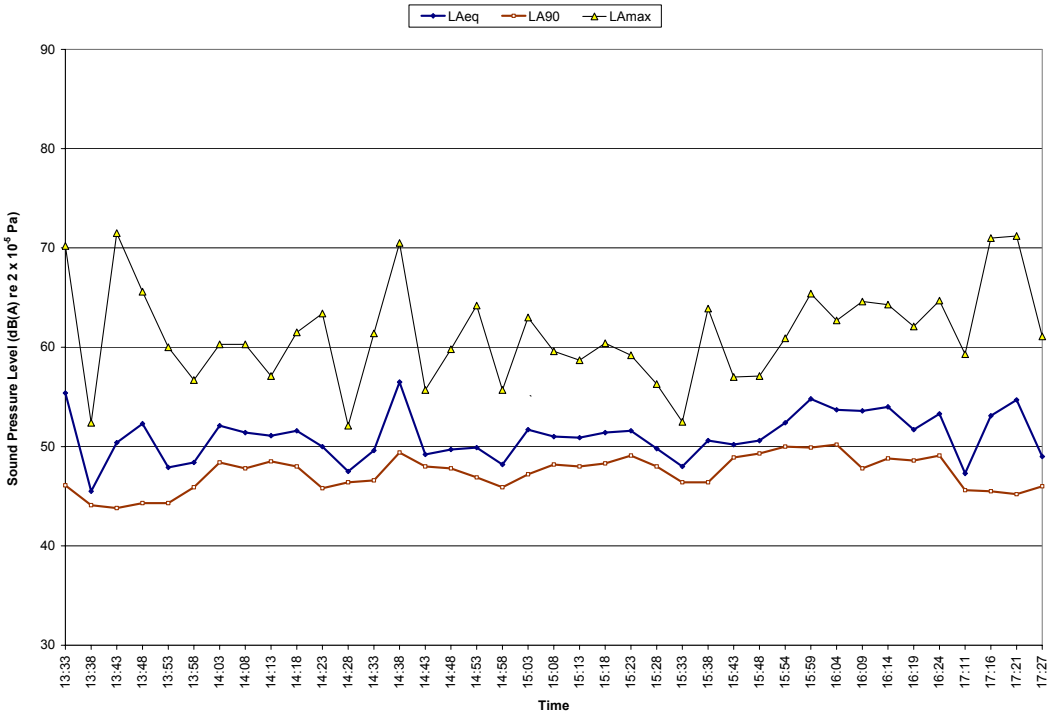
Graph A2: Summary Statistical Noise Levels – Position 1 – Night Time, 14th to 15th October 2015



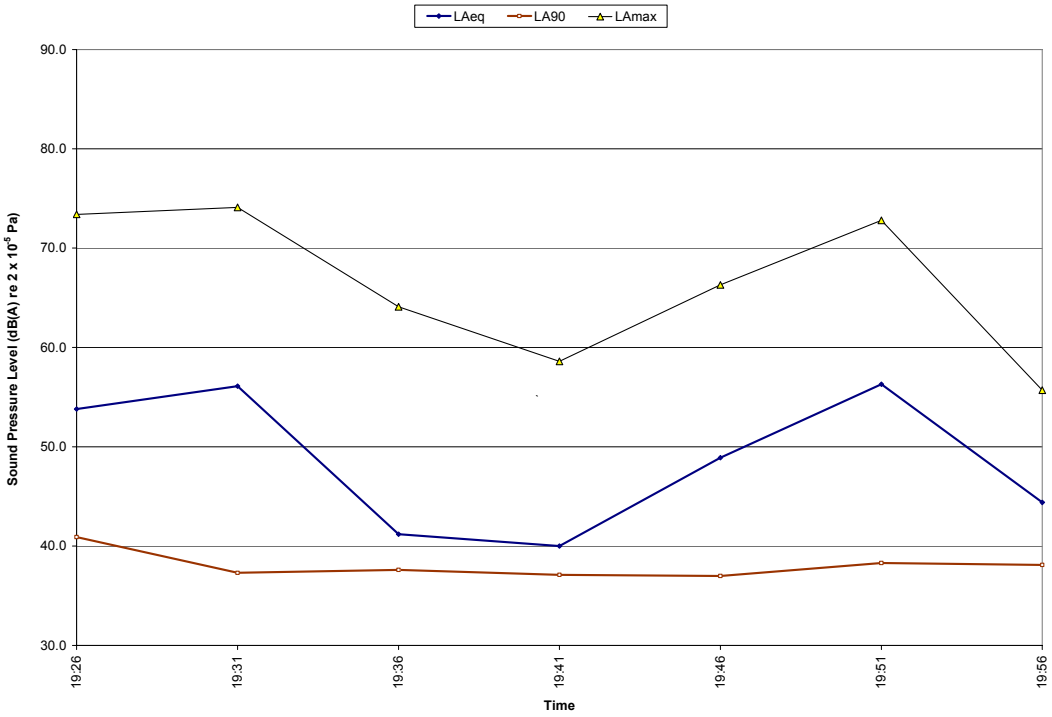
Graph A3: Summary Statistical Noise Levels – Position 2 - Daytime, 14th October 2015



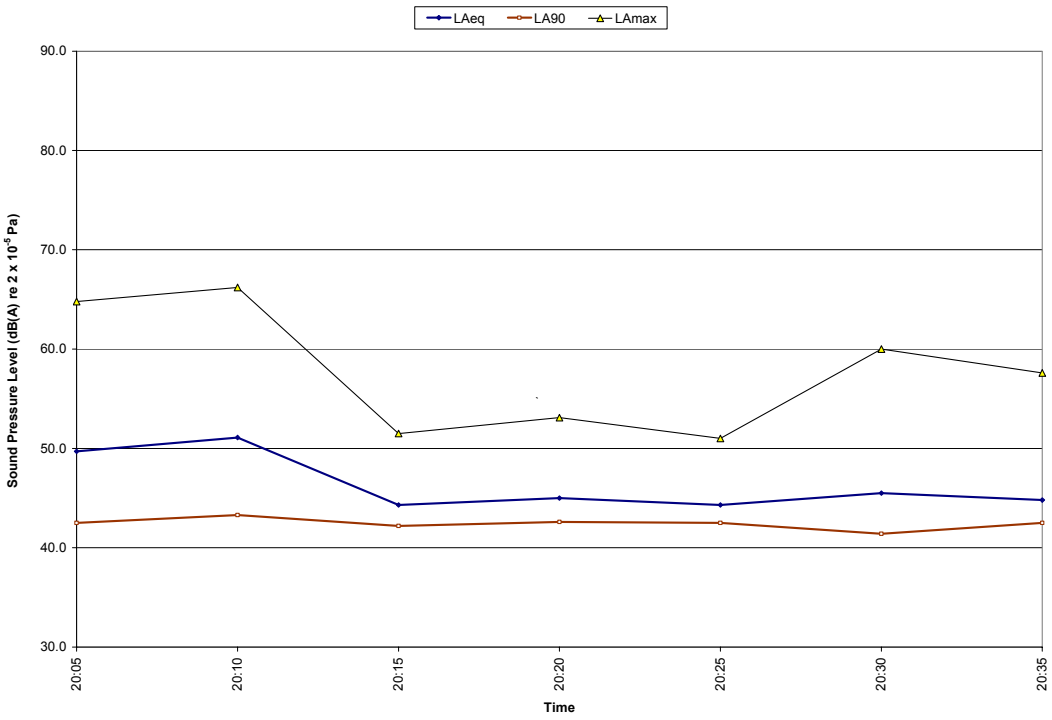
Graph A4: Summary Statistical Noise Levels – Position 2 – Night Time, 14th to 15th October 2015



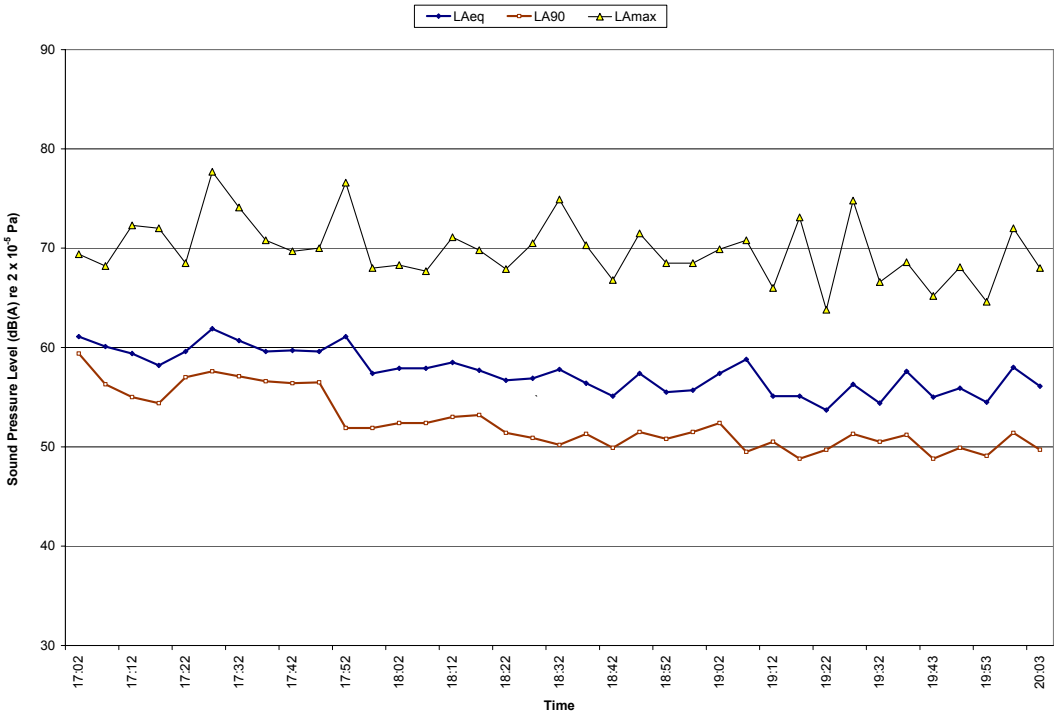
Graph A5: Summary Statistical Noise Levels – Position 3 - Daytime, 14th October 2015



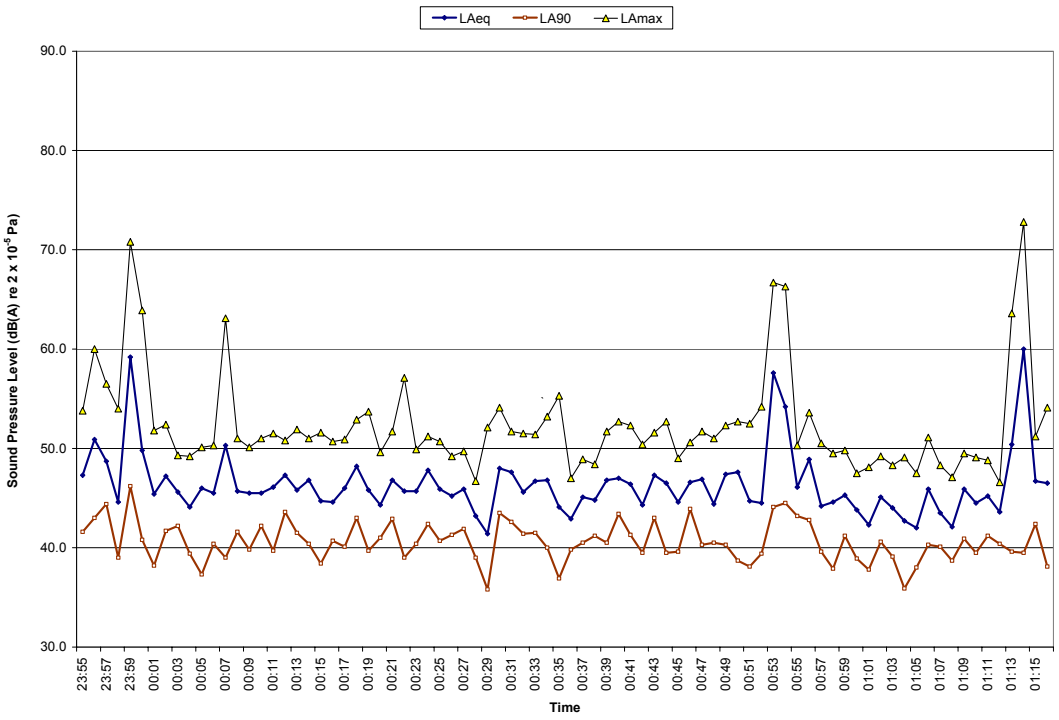
Graph A6: Summary Statistical Noise Levels – Position 4 - Daytime, 14th October 2015



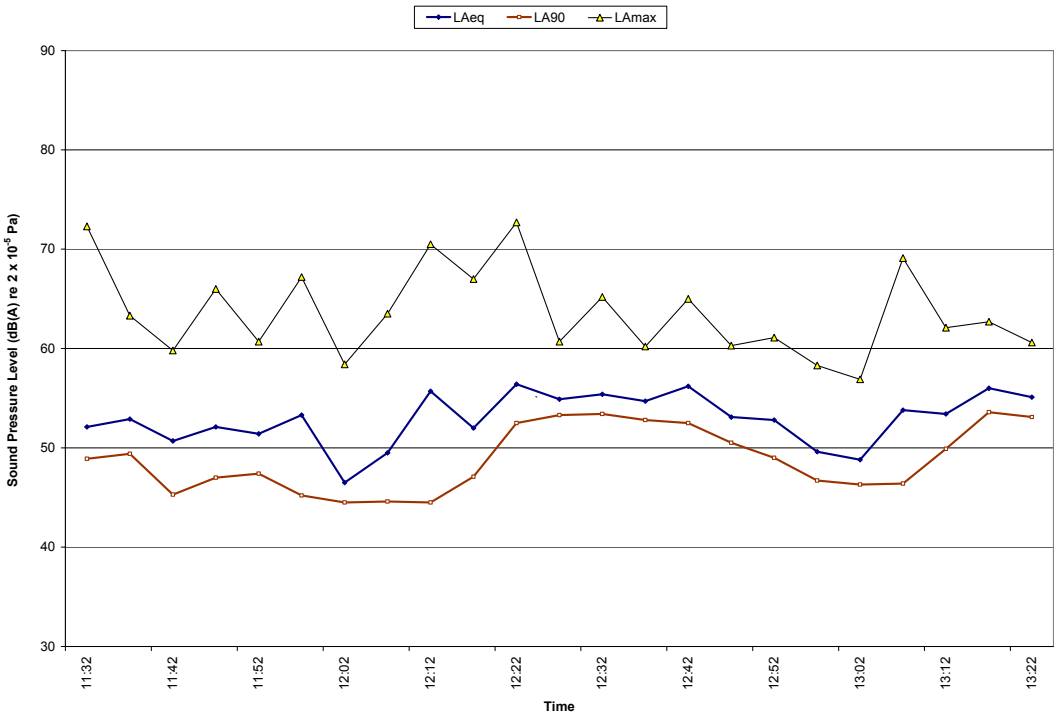
Graph A7: Summary Statistical Noise Levels – Position 5 - Daytime, 14th October 2015



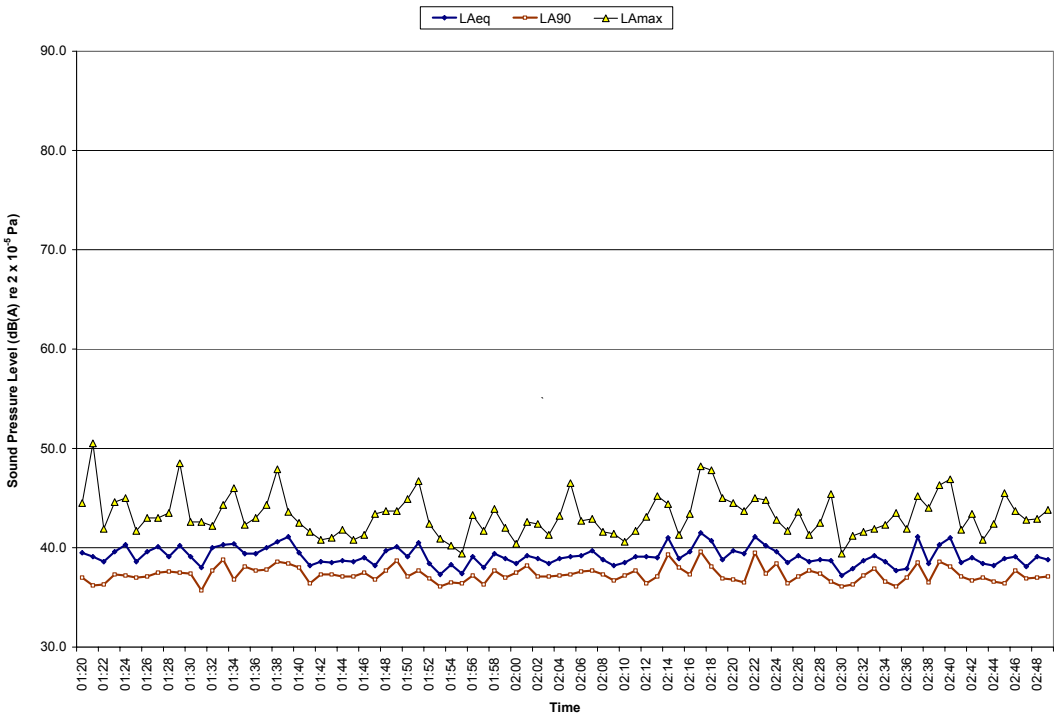
Graph A8: Summary Statistical Noise Levels – Position 6 - Daytime, 14th October 2015



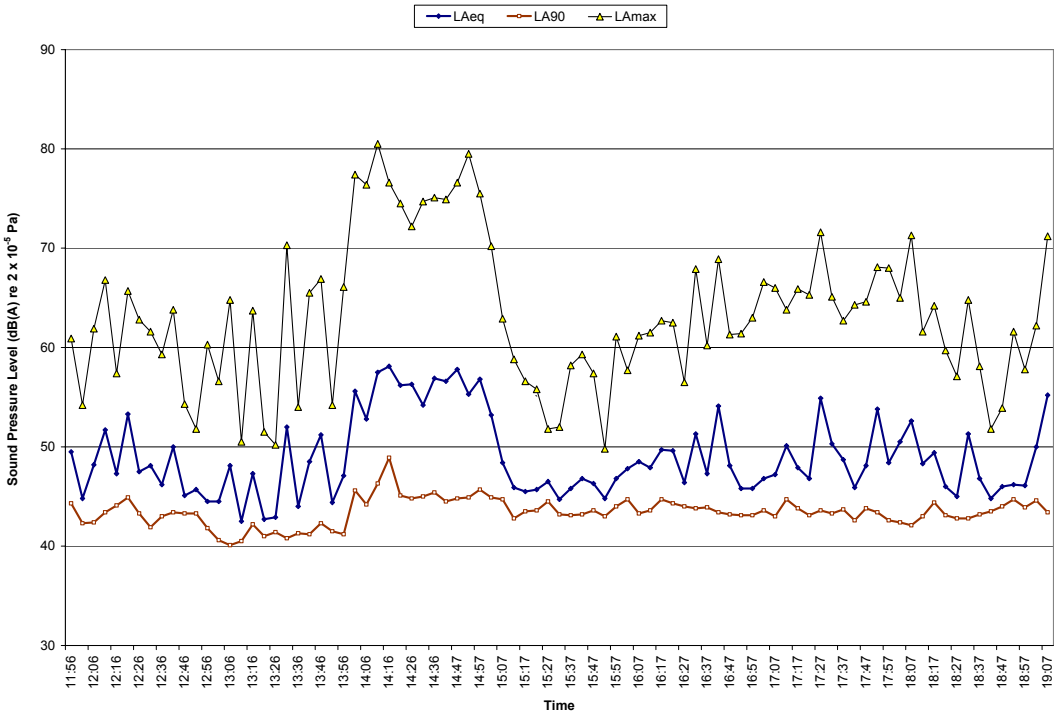
Graph A9: Summary Statistical Noise Levels – Position 6 – Night Time, 14th to 15th October 2015



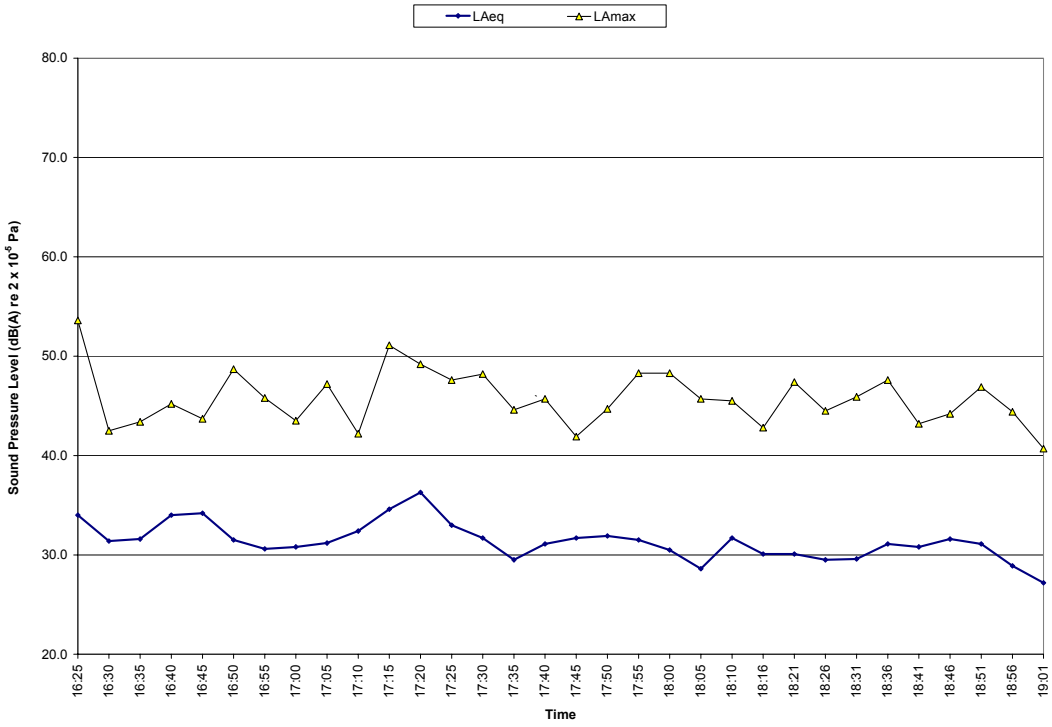
Graph A10: Summary Statistical Noise Levels – Position 7 - Daytime, 14th October 2015



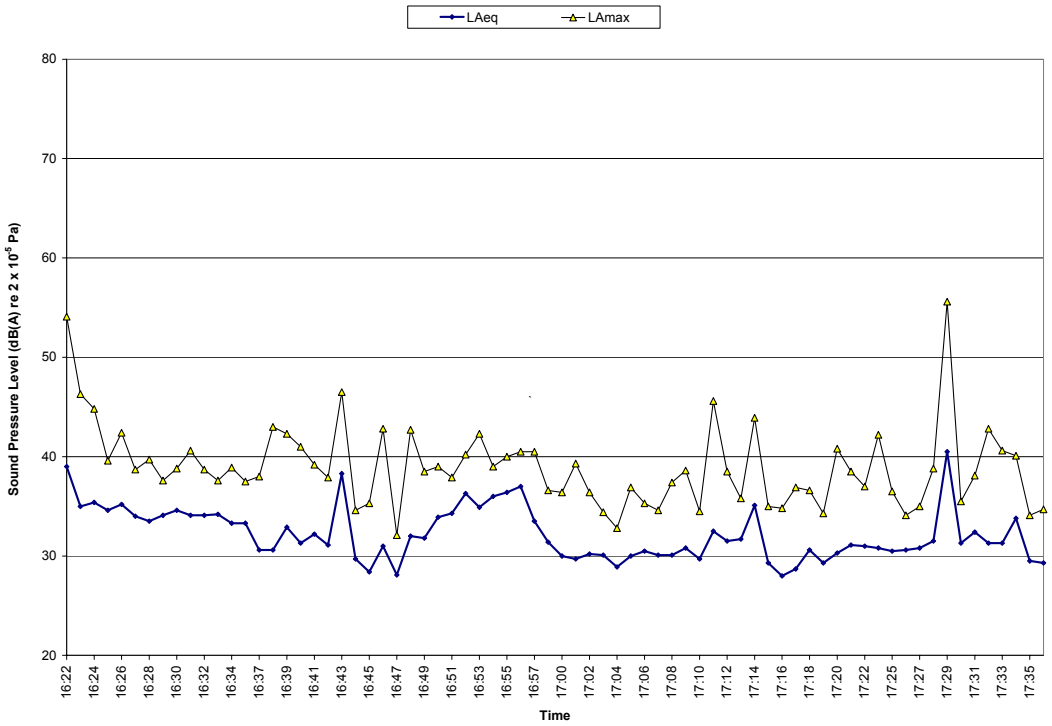
Graph A11: Summary Statistical Noise Levels – Position 7 – Night Time, 14th to 15th October 2015



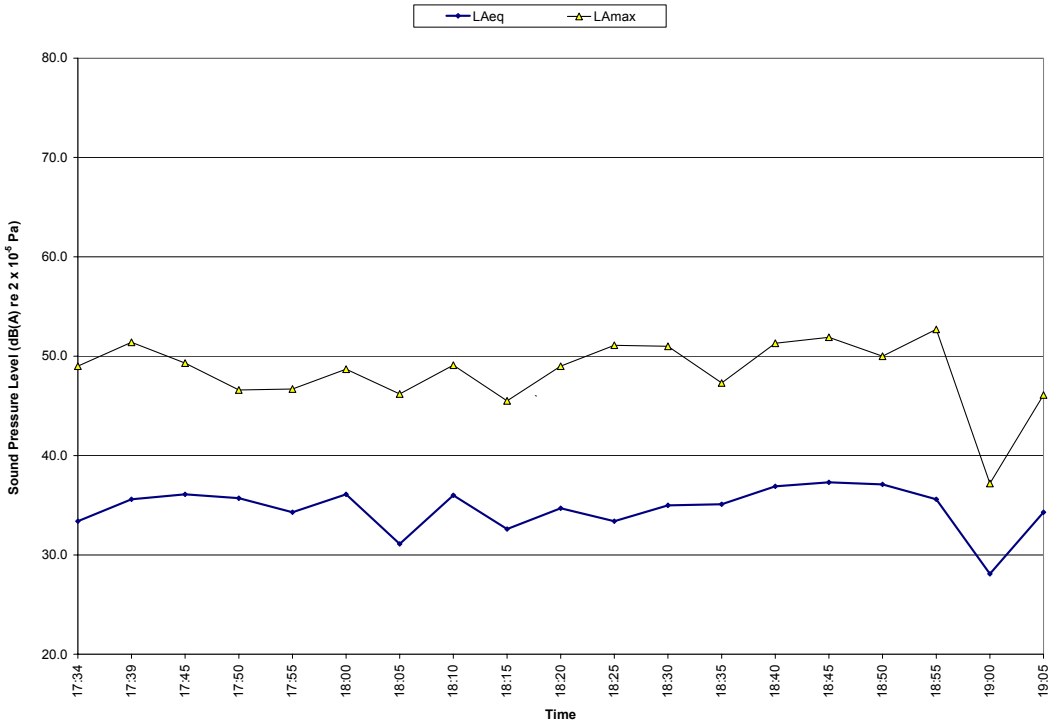
Graph A12: Summary Statistical Noise Levels – Position 8 - Daytime, 14th October 2015



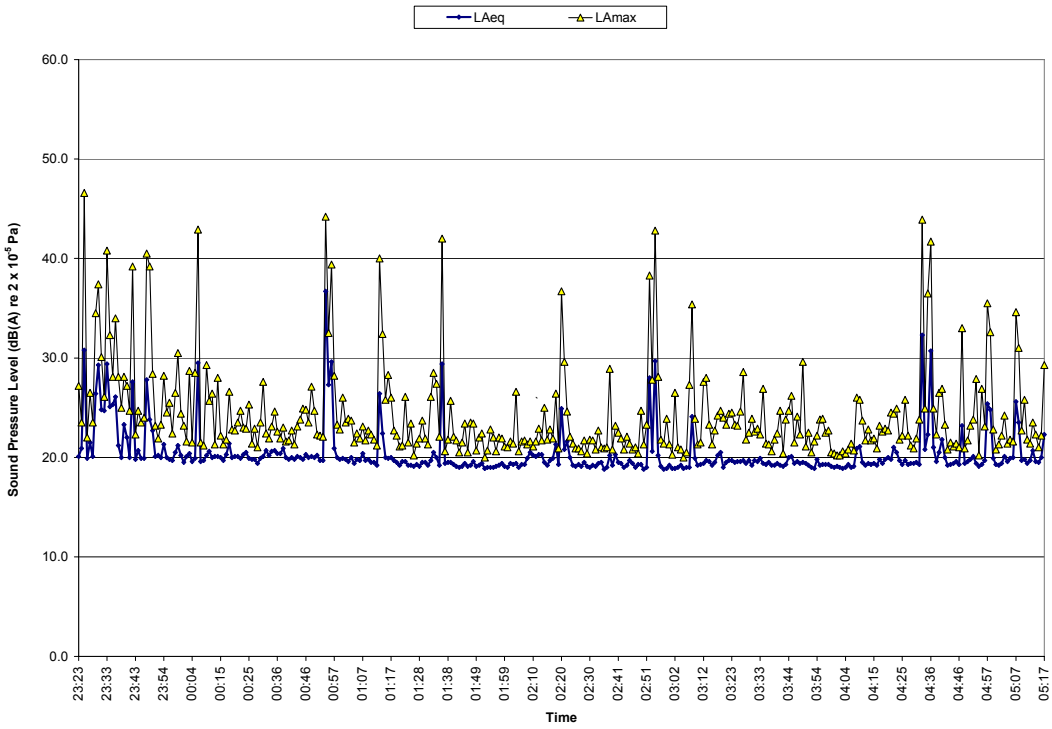
Graph A13: Intrusive Noise Levels – Kidderpore House Ground Floor Internal - Daytime, 14th October 2015



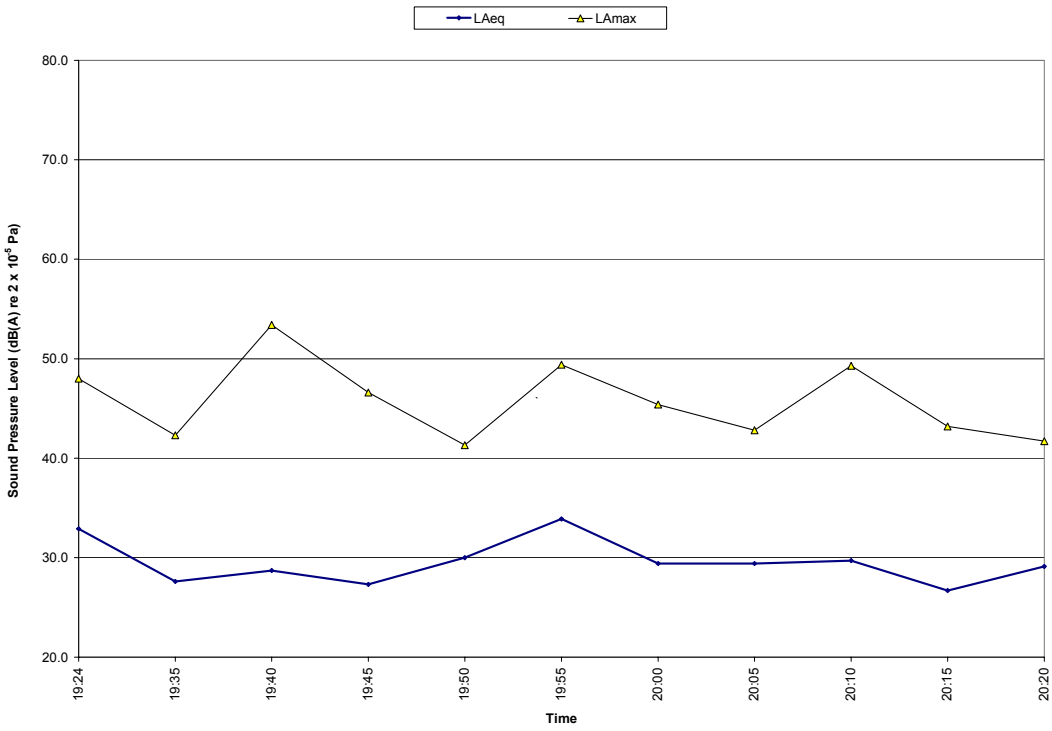
Graph A14: Intrusive Noise Levels – Kidderpore House First Floor Internal - Daytime, 14th October 2015



Graph A15: Intrusive Noise Levels – Skeel House First Floor Internal - Daytime, 14th October 2015



Graph A16: Intrusive Noise Levels – Skeel House Ground Floor Internal – Night Time, 14th – 15th October 2015



Graph A17: Intrusive Noise Levels – Bay House Ground Floor Internal - Daytime, 14th October 2015