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Report 1044/PPG24/R1
Issue Date 9th November 2009

Project **40 Bedford Square**
London WC1B 3HX

Title **Environmental Noise Survey and Assessment**
Sub Title **Planning Policy Guidance 24**

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Revision	Reason	Checked	Signature

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Environmental Noise Survey and Assessment
Planning Policy Guidance 24

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1. INTRODUCTION

1.1 An environmental noise investigation and report has been commissioned by Brian O'Reilly Architects Ltd. The Studio 31 Oval Road London NW1 7EA for a proposed development site at 40 Bedford Square London WC1B 3HX.

1.2 As the proposal is a noise sensitive development being introduced to an existing noise source (road traffic noise), a noise assessment has been undertaken in accordance with the requirements of Planning Policy Guidance 24 and the Local Authority, London Borough of Camden.

1.3 This report presents the results of noise logging measurements. Attended measurements have also been made to more fully characterise the noise climate. An assessment of the proposed development is made, concentrating on the most affected habitable rooms.

1.4 We have use the following data in preparing the report:

- Results of Adnitt Acoustics attended and automated noise measurements carried out between Wednesday 4th November 2009 and Thursday 5th November 2009, described in the following.
- O'Reilly Architecture drawings.

2. NOISE PRINCIPLES AND STANDARDS USED

2.1 The noise level measurements and calculations have been made in general accordance with the procedures set out in:

- British Standard BS 7445-1:2003 'Description and measurement of environmental noise. Part 1: Guide to quantities and procedures'.
- British Standard BS 7445-2:1991: 'Description and measurement of environmental noise. Part 2: Acquisition of data pertinent to land use'
- Planning Policy Guidance 24 (PPG24): Planning and Noise.

2.2 For internal noise levels PPG24 refers to the guidance provided in BS8233:1999 'Sound insulation and noise reduction for buildings – Code of practice'.

2.3 The London Borough of Camden Replacement Unitary Development Plan (UDP) Adopted June 2006 uses Tables A-D of Appendix A and PPG24 as the current standard for planning policy with respect to noise sensitive developments.

2.4 Noise units used are defined in Appendix A - Glossary of Acoustic Terminology.

3. THE SITE AND ITS SURROUNDINGS

3.1 The proposed development is on the site of 40 Bedford Square London WC1B 3HX. The current site layout is shown in the attached site plan 1044/SP1.

3.2 Currently the building is occupied by offices, and the proposal is for the building to be converted to a house and house keeper flat at the front (facing Bedford square) and four flats in the rear building.

3.3 The current area is a mixture of residential and commercial units. The site is located on the corner of Bedford Square with Adeline place to the west boundary and Bedford Avenue to the south boundary. There are very busy roads nearby; Bedford square itself does not carry very many vehicles, though Buses and HGVs do travel along Adeline Place.

3.4 Traffic noise from the aforementioned roads is the main constituent of the underlying ambient noise climate.

4. MEASUREMENT METHODOLOGY

Automated Noise Logging Measurements

4.1 An environmental noise survey was carried out between 11:30 hours on Wednesday 4th November 2009 and 10:50 hours Thursday 5th November 2009 to obtain full daytime and night-time ambient noise monitoring results.

4.2 Two measurement positions were used. At position 1 the microphone was mounted on an A-frame 1 m from the façade facing Bedford Square at second floor window height (10m above ground level). At position 2 the microphone was mounted on a tripod on the first floor balcony 1m from the façade facing Adeline Place (5m above ground level). The noise measurement positions are shown on the attached site plan 1044/SP1 and site elevation drawing 1044/SE1.

4.3 A-weighted L_{eq}, $L_{max(FAST)}$, $L_{max(SLOW)}$, L_{10}, and L_{90} sound pressure levels were measured continuously during the survey, at 5 minute measurement periods.

Attended Measurements

4.4 An attended measurement was made 12:10 on Wednesday 4th November 2009 at the rear of the building 1m from the façade facing Bedford Avenue, the microphone was 1.5m above the ground mounted on a tripod. The measurement position is indicated (position 3) on the attached site plan 1044/SP1.

4.5 A-weighted L_{eq}, $L_{max(FAST)}$, $L_{max(SLOW)}$, L_{10}, and L_{90} sound pressure levels were measured for a 5 minute measurement period simultaneously with the automated noise logging measurements.

Survey Equipment

4.6 The equipment used is detailed in Table 1044/T1 below. The sound level meters were fitted with windshields. All measurement systems were calibrated before the measurements and checked at the end of survey. No variations in level were observed. The calibration is traceable to national Standards, the certificates for which are available on request.

Equipment			**Calibration**	
Description	**Manufacturer & Type Number**	**Serial Number**	**Last Date**	**Certificate Number**
Integrating sound level meter	Norsonic 118	31778	17-Aug -08	4201
Acoustic Calibrator	Norsonic 1251	31324	21-Sep-09	5793
Environmental Microphone	GRAS 41-AL-S	49742	N/A	N/A
Sound & Vibration Analyser	SVANTEk 948	6508	30-Sep-08	6508
Integrating sound level meter	Norsonic 118	31349	Oct. 2008	4365
Acoustic Calibrator	Norsonic 1251	31161	Oct. 2009	5920

Table 1044/T1 – Survey Equipment List

5. NOISE SURVEY RESULTS

Automated Noise Logging Measurements

5.1 Table 1044/T2 shows the results of the Automated Noise Logging Measurements at Positions 1 and 2. The results have been corrected to free-field noise exposure levels 1m from the relevant façade including a correction due to façade reflections.

5.2 The results of the unattended noise survey are presented in Figures 1044/TH1 and 2, attached.

	Time Period		$L_{Aeq,T}$, dB	Typical $L_{Amax,Fast}$, dB	Typical $L_{Amax,Slow}$, dB	Minimum L_{A90}, dB
Position 1	16 hour	07:00 - 23:00	61.0	79.4	75.1	46.2
	Day	07:00 - 19:00	61.6	80.2	75.9	45.3
	Evening	19:00 - 23:00	57.3	74.8	70.9	46.2
	Night	23:00 - 07:00	54.5	71.3	68.2	40.2
Position 2	16 hour	07:00 - 23:00	59.2	76.9	73.9	46.9
	Day	07:00 - 19:00	59.8	77.7	74.6	47.7
	Evening	19:00 - 23:00	57.0	74.0	71.7	46.9
	Night	23:00 - 07:00	54.1	72.9	69.6	41.3

Table 1044/T2 – Automated Noise Logging Survey Results

5.3 To obtain the $L_{Aeq,T}$ the 5 minute measurements were logarithmically averaged within the relevant time period. The typical $L_{AMax,SLOW}$ and typical $L_{AMax,Fast}$ values have been calculated from the average value plus one standard deviation of the results in the relevant time period. The minimum L_{A90} is the minimum 5 minute value measured in the relevant time period.

5.4 The weather conditions during the survey are understood to have been generally dry with only occasional short periods of light rain and drizzle and with wind speeds below maximum limits recommended in BS4142. Measurements were carried out close to fireworks night, though results are assumed not to have been affected by firework noise.

5.5 Figure 1044/OB1 shows the octave band L_{Aeq} and $L_{Amax,Fast}$ noise levels measured at position 1 to be used for the external building fabric assessment.

Attended Measurements

5.6 Table 1044/T3, below shows the results of the attended measurement at position 3 and the equivalent simultaneously measured values from positions 2 and 3. The results have been corrected to free-field noise exposure levels 1m from the relevant façade including a correction due to façade reflections.

Position	Date and time	$L_{Aeq,5mins}$, dB	$L_{AF(max)}$, dB	L_{A10}, dB	L_{A90}, dB
3	2009/11/04 12:09:56	55.3	65.9	57.4	51.3
2	2009/11/04 12:10:52	56.0	66.7	58.6	51.2
1	2009/11/04 12:10:00	59.0	70.1	61.5	53.0

Table 1044/T3 – Attended Measurement Results

6. NOISE CRITERIA

6.1 Noise criteria are based upon The London Borough of Camden Replacement Unitary Development Plan (UDP) Adopted June 2006 (saved policies version). Policy SD7B states:

"B - Noise/vibration pollution

Unless appropriate attenuation measures are available and are included, the Council will not grant planning permission for: a) development likely to generate noise/vibration pollution; or b) development sensitive to noise/vibration in locations with noise/vibration pollution."

6.2 In the notes regarding the above policy the UDP states:

"1.48 The Council will only grant planning permission for development sensitive to noise/vibration in locations that experience noise/vibration pollution if appropriate attenuation measures are taken. Table B sets out noise pollution levels from road and rail at and above which attenuation measures will be required before planning permission is granted for adjoining residential sites.

1.49 Planning permission will not be granted for development sensitive to noise/vibration in locations that have unacceptable levels of noise/vibration. Tables A and C set out unacceptable noise and vibration levels from road and rail at and above which planning permission will not be granted for adjoining residential sites."

6.3 Tables A and B of the UDP, referenced above are reproduced below:

APPENDIX 1 - NOISE AND VIBRATION THRESHOLDS

Table A: Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	74 dB L_{Aeq},12h	72 dB L_{Aeq},12h
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	74 dB L_{Aeq},4h	72 dB L_{Aeq},4h
Noise at 1 metre external to a sensitive façade	Night	2300-0700	66 dB L_{Aeq},8h	66 dB L_{Aeq},8h

Table B: Noise levels on residential sites adjoining railways and roads at and above which attenuation measures will be required

Noise description and measurement location	Period		Sites adjoining railways	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	65 dB L_{Aeq},12h	62 dB L_{Aeq},12h
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	60 dB L_{Aeq},4h	57 dB L_{Aeq},4h
Noise at 1 metre external to a sensitive façade	Night	2300-0700	55 dB L_{Aeq},1h	52 dB L_{Aeq},1h
Individual noise events several times an hour	Night	2300-0700	>82dB L_{Amax} (S time weighting)	>82dB L_{Amax} (S time weighting)

6.4 The UDP also indicates that the Council may require an acoustic report to ensure compliance with PPG24 as well as tables A-D. The following sections are taken from PPG24: Annex 1 : Noise Exposure Categories For Dwellings.

6.5 When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as below:

NEC	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 1044/T2 – PPG24 Noise Exposure Categories

	Noise Level[0] Corresponding To The Noise Exposure Categories For New Dwellings $L_{Aeq,T}$ dB			
	Noise Exposure Category			
Noise Source	**A**	**B**	**C**	**D**
Road Traffic				
07.00 - 23.00	<55	55 – 63	63 – 72	>72
23.00 - 07.00[1]	<45	45 – 57	57 – 66	>66
Rail Traffic				
07.00 - 23.00	<55	55 – 66	66 – 74	>74
23.00 - 07.00[1]	<45	45 – 59	59 – 66	>66
Air Traffic[2]				
07.00 - 23.00	<57	57 – 63	66 – 72	>72
23.00 - 07.00[1]	<48	48 – 57	57 – 66	>66
Mixed Sources[3]				
07.00 - 23.00	<55	55 – 63	63 – 72	>72
23.00 - 07.00[1]	<45	45 – 57	57 – 66	>66

Notes

[0]**Noise levels:** the free field noise level(s) ($L_{Aeq,T}$)used when deciding the NEC of a site should be representative of typical conditions.

[1]**Night-time noise levels (23.00 - 07.00):** sites where individual noise events regularly exceed 82dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the LAeq,8h (except where the LAeq,8h already puts the site in NEC D).

Table 1044/T3 – PPG24 NEC Boundary Values

6.6 Where attenuation measures are to be required reference is made to desirable internal noise levels contained in BS8233:1999: 'Sound insulation and noise reduction for buildings - Code of practice'. Based on this Standard and the advice contained in PPG24, the following design criteria are proposed:

Desirable Noise Level Criteria for Residential Developments to Achieve a Reasonable Noise Climate			
Period, hrs	**Room Type**	**$L_{Aeq,T}$,dB**	**$L_{Amax,FAST}$,dB**
07.00 – 23.00	Bedroom	40	50-55[2]
	Living Area[1]	40	50-55[2]
	External Amenity	50-55	-
23.00 – 07.00	Bedroom	35	45
	Living Area[1]	40	-

Note

[1]Living Areas: any habitable room not in use as the principal sleeping area(eg. living, dining, study,etc.), including non-habitable rooms open to these spaces (eg. kitchen).

[2]Daytime single-noisy events: it is advisable to aim for an internal noise level which will ensure events are not significantly louder than ambient L_{Aeq} noise levels, but higher noise levels can be acceptable particularly for subjectively predictable noise sources (eg.trains).

Table 1044/T4 – Desirable Internal Noise Level Criteria

7. EVALUATION OF NOISE EXPOSURE

7.1 The data has been analysed in accordance with the requirements of PPG24. The results of the noise measurements are summarised below in Table 1044/T7.

7.2 The results have been adjusted to obtain the noise levels at each façade, including corrections for façade reflections, angle of view corrections and any appropriate screening.

7.3 Based on the noise survey results, the following noise exposure levels and PPG24 noise exposure categories are identified for the different facades of the proposed building.

Façade	$L_{Aeq,16h}$ (dB)	NEC	$L_{Aeq,8h}$ (dB)	NEC	Typical Night $L_{Amax,\ Slow}$ (dB)
Bedford Square	61	B	55	B	68
Adeline Place	59	B	54	B	70
Bedford Avenue	58	B	52	B	67

Table 1044/T5 – Summary Noise Exposure Levels to Building Facades

7.4 Night time $L_{Amax,Slow}$ events are below the PPG24 criteria of 82dB(A) several times in any hour.

7.5 Based on the above the following guidance from PPG24 applies:

- Noise Exposure Categories (NEC) B – 'Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise'.

7.6 The day, evening and night time noise exposure levels are at or above the values provided in Table B of the UDP to indicate that the council will require attenuation measures, though they are below the values provided in Table A which would determine whether planning permission should be granted.

7.7 The practical design approach for Noise Exposure Categories (NEC) B may be summarised as follows:

- Specific calculated assessment required of sound insulation for all elements of the building envelope. Moderate performance thermal double glazing; moderate sound insulation for non-vision areas and roof; acoustically-rated ventilators will be required on loudest facades as a basic means of continuous ventilation and a means of alternative rapid ventilation to openable windows will need to be considered.

7.8 Provided the internal noise climate can be maintained at a reasonable standard and occupants will have a satisfactory alternative to openable windows, there is no reason why, acoustically, the residential development cannot be thought feasible.

8. EVALUATION OF BUILDING ENVELOPE

8.1 The calculations have been based on the current proposed site layout as specified in the O'Reilly Architecture drawings.

8.2 On the above basis, the following required sound insulation performances have been calculated for the individual building elements.

Building Elements		Minimum Sound Reduction Index, R (dB), @ Octave Band Centre Frequency (Hz				
	Ref.	125	250	500	1000	2000
Windows	A	23	24	34	44	43
External Wall	B	41	45	45	54	58

Table 1044/T6 – Building Envelope Performance Requirements

Building Elements		Minimum Normalised Element Level Difference D_{ne} (dB), @ Octave Band Centre Frequency (Hz)				
	Ref.	125	250	500	1000	2000
Acoustic Ventilators	C	30	33	38	37	36

Table 1044/T7 – External Ventilators Performance Requirements

8.3 The assessment was carried out using the measured octave band noise spectrum given in Figure 1044/OB1.

8.4 The following constructions are quoted as typical examples that could meet the acoustic performance, however, alternative and approved methods may be used, particularly, other disciplines may require modified constructions:

Building Element Ref.	Typical construction
A	Moderate performance double glazing such as 6/16/6.8 with laminated pane
B	Cavity Masonry Wall
C	Moderate performance ventilation such as acoustic trickle vent

* : window / door performance is dependent on elements of the window unit including the frames, seals, wall interface, etc. Weak non-glass elements will require the use of higher performance glass units to maintain the required sound insulation.

Table 1044/T8 – Typical Constructions

8.5 Selection of external building elements was controlled by achieving recommended maximum internal noise levels (L_{Amax}).

Performance Substantiation

8.6 The manufacturers/suppliers of the above elements should confirm the sound insulation performance of the proposed construction. Independent UKAS accredited laboratory test results shall be used to substantiate the performance for all parts of each building element. The performance shall apply to the system as a whole not to individual components of it (e.g. for the whole window system not the glass alone).

8.7 Tests shall be in accordance with BS EN ISO 140 Part 3: Laboratory measurements of airborne sound insulation of building elements and Part 10: Laboratory measurement of airborne sound insulation of small building elements.

9. CONCLUSION

9.1 The report presents the results of day and night-time environmental noise measurements representative of the proposed development at 40 Bedford Square London WC1B 3HX.

9.2 The noise exposure levels to the facades of the building are at or above the noise levels given by London Borough of Camden for residential sites adjoining roads at and above which attenuation measures will be required.

9.3 The assessed daytime and night-time ambient noise levels show that the proposed site should be treated as being in the Noise Exposure Category (NEC) B.

9.4 The practical design approach for NEC B may be summarised as follows:

NEC B: Specific calculated assessment required of sound insulation for all elements of the building envelope. Moderate performance thermal double glazing; moderate sound insulation for non-vision areas and roof; acoustically-rated ventilators will be required on loudest facades as a basic means of continuous ventilation and a means of alternative rapid ventilation to openable windows will need to be considered.

9.5 Recommendations have been given for building envelope sound insulation performance, to achieve reasonable internal noise levels and, thus, mitigate noise exposure.

9.6 Provided these or similar measures are implemented, the development is expected to attain the requirements of local planning policy and national guidance.

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for ADNITT ACOUSTICS

APPENDIX A: GLOSSARY OF ACOUSTIC TERMINOLOGY

Sound Level	The level of sound measured with a sound level meter. Expressed in decibels, this is a measure of the ratio of the level of pressure generated by the sound compared to a standard reference pressure level.
Decibel scale dB	A linear numbering scale used to define a logarithmic amplitude scale, thereby compressing a wide range of amplitude values to a small set of numbers
dB(A)	An electronic filter in a sound level meter, which approximates under defined conditions the frequency response of the human ear.
$L_{Aeq,T}$	The equivalent continuous sound level. The steady dB(A) level which would produce the same A-weighted sound energy over a stated period of time as the measured sound pressure level.
L_{Amax}	The maximum dB(A) level measured during a survey period.
L_{A10}	The dB(A) level exceeded for 10% of the survey period, often used as a quantifier of traffic noise level.
L_{A90}	The dB(A) level exceeded for 90% of the survey period. Used in BS 4142:1997as being representative of the background noise level.

Figure 1044/ SP 1 : Site Plan Showing Measurement Positions

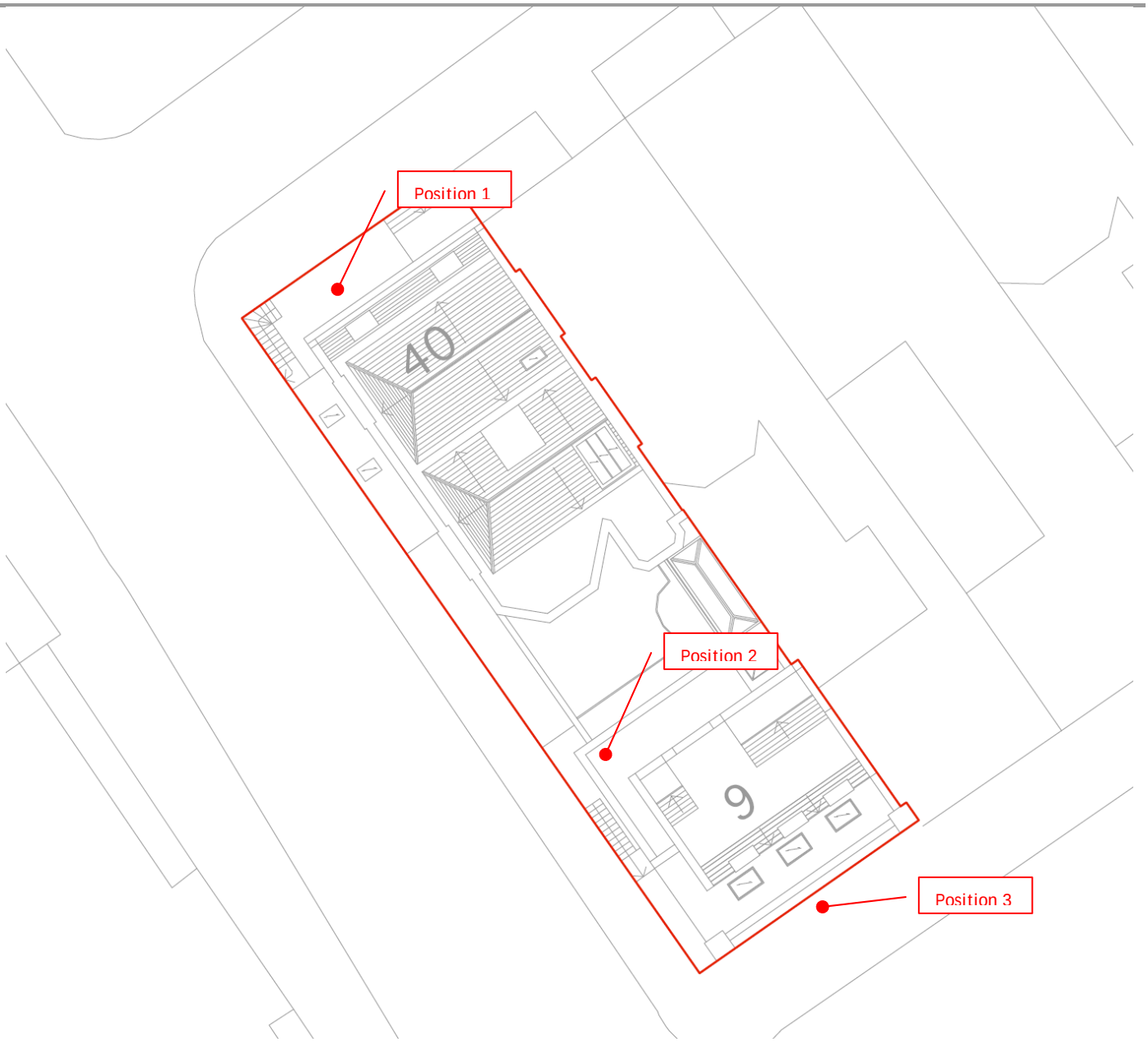


Figure 1044/ SE 1 : Site Elevation Drawing Showing Measurement Positions

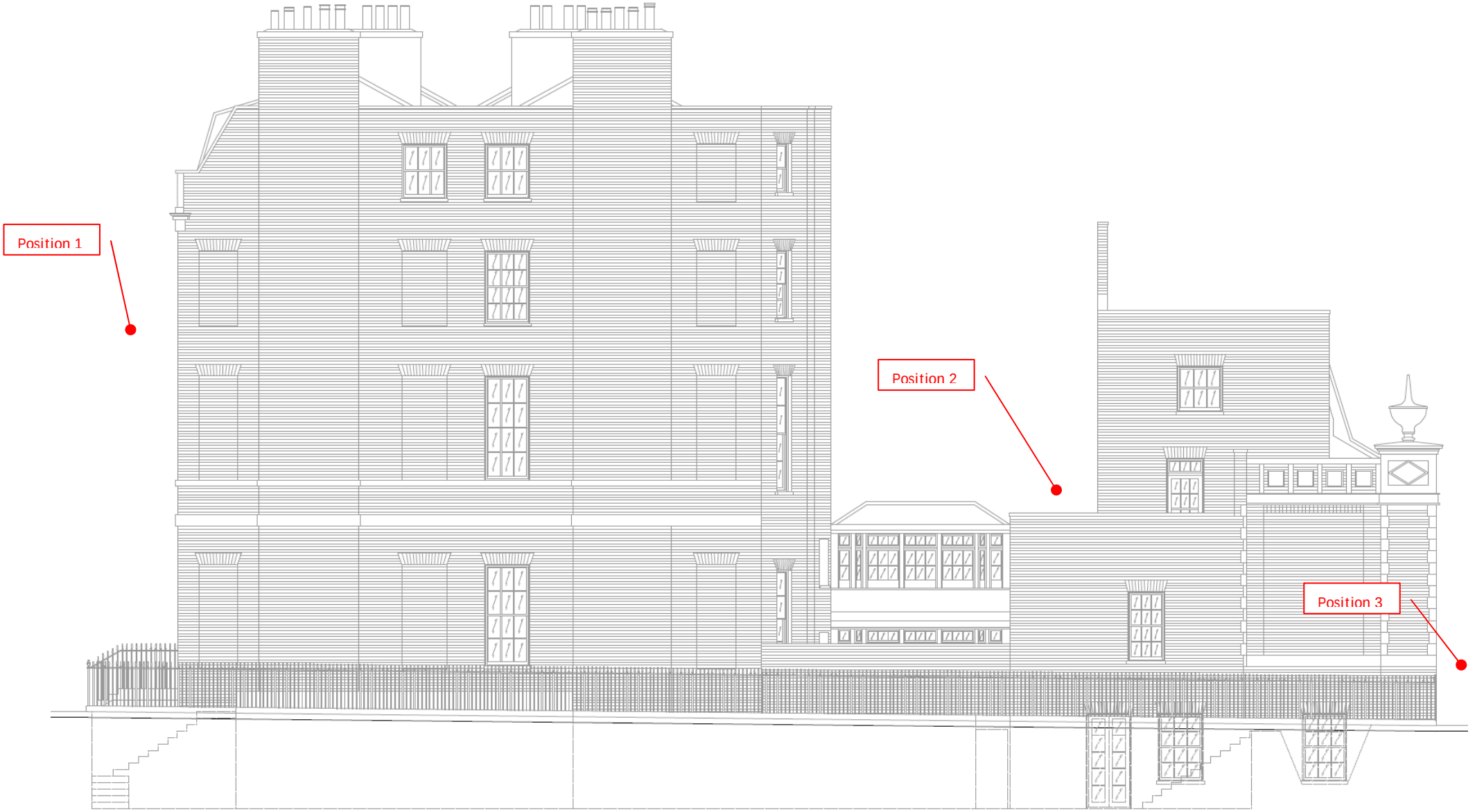


Figure 1044/ TH 1 : Noise Logging Measurements Time History at Position 1

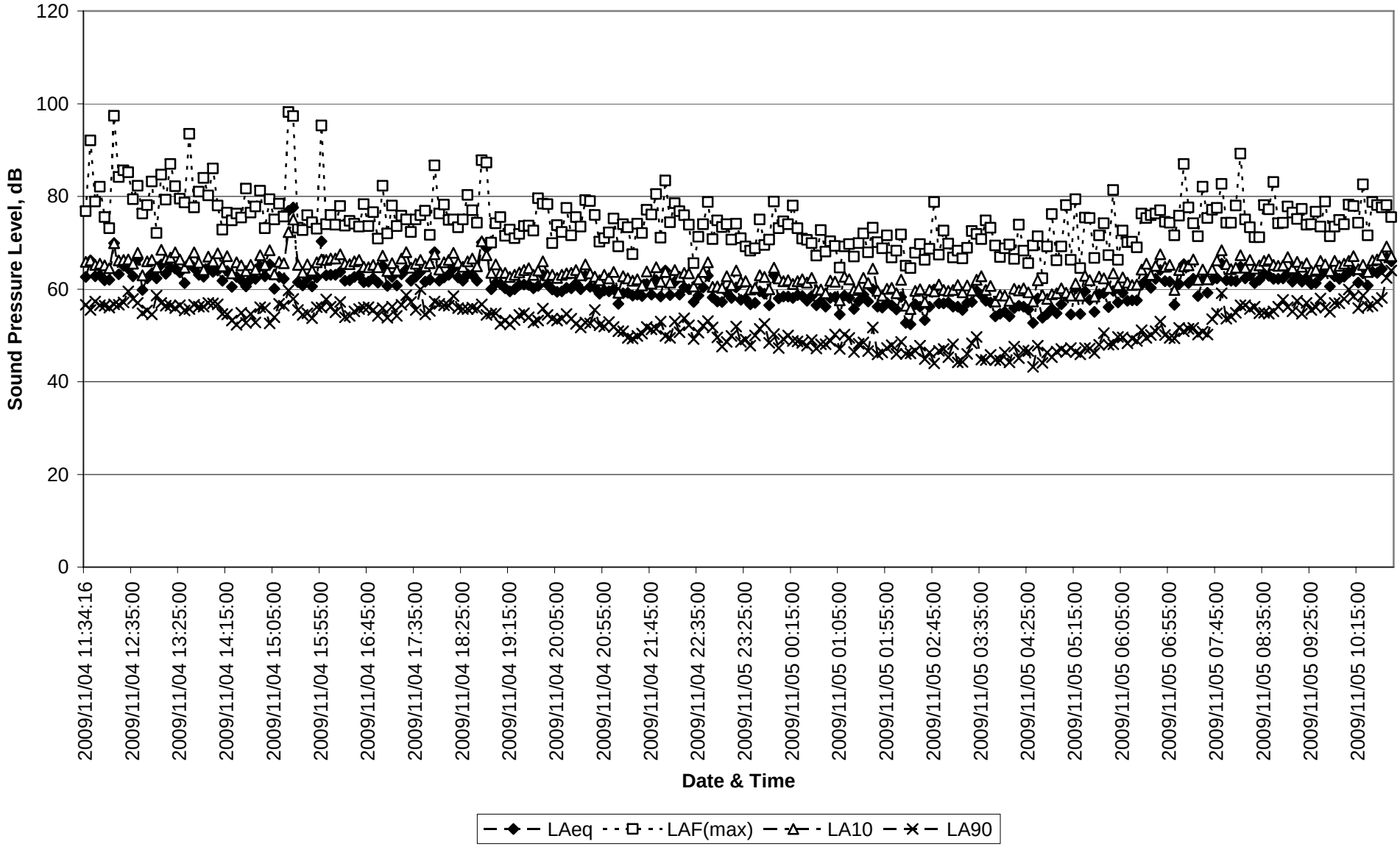


Figure 1044/ TH 2 : Noise Logging Measurements Time History at Position 2

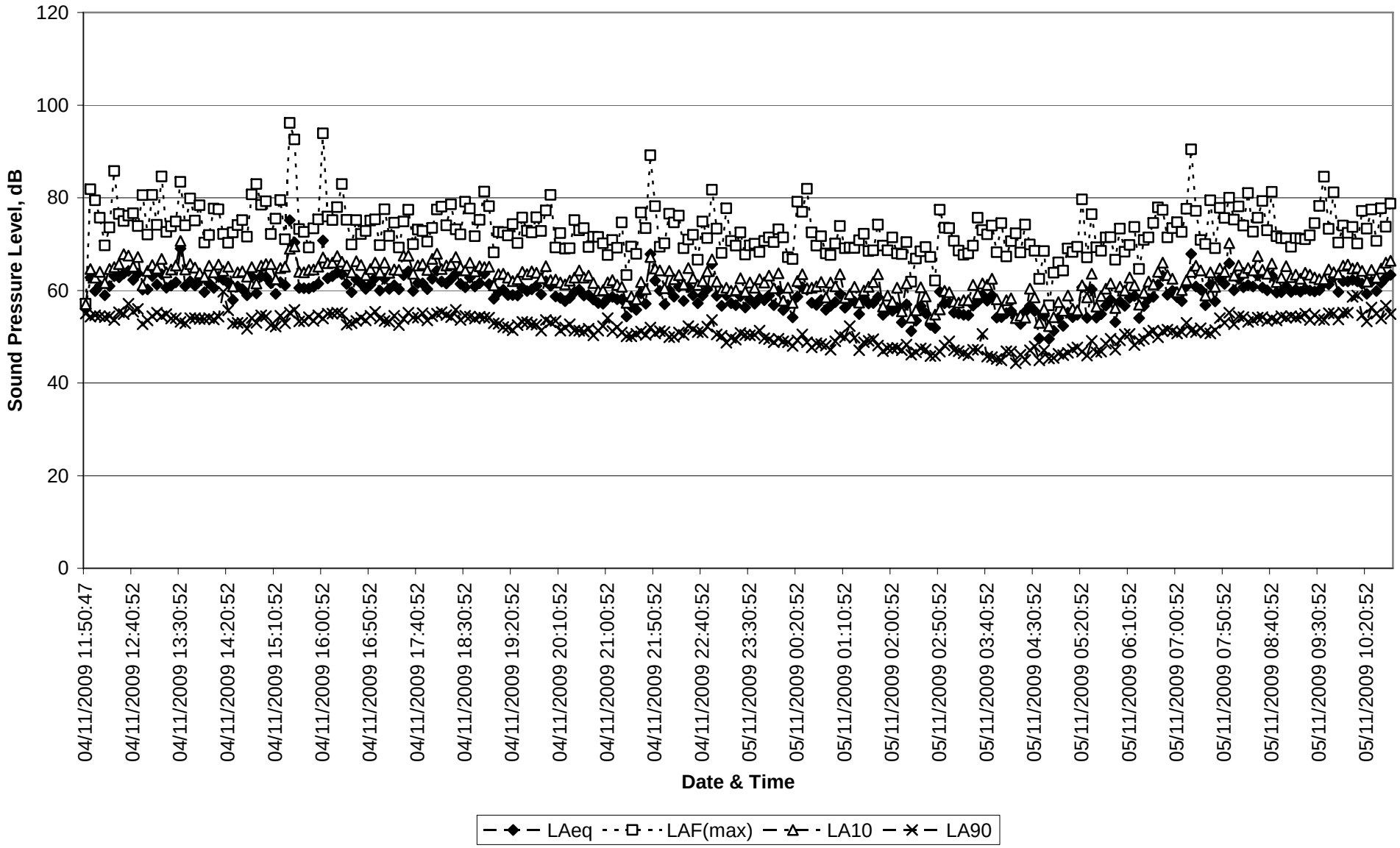
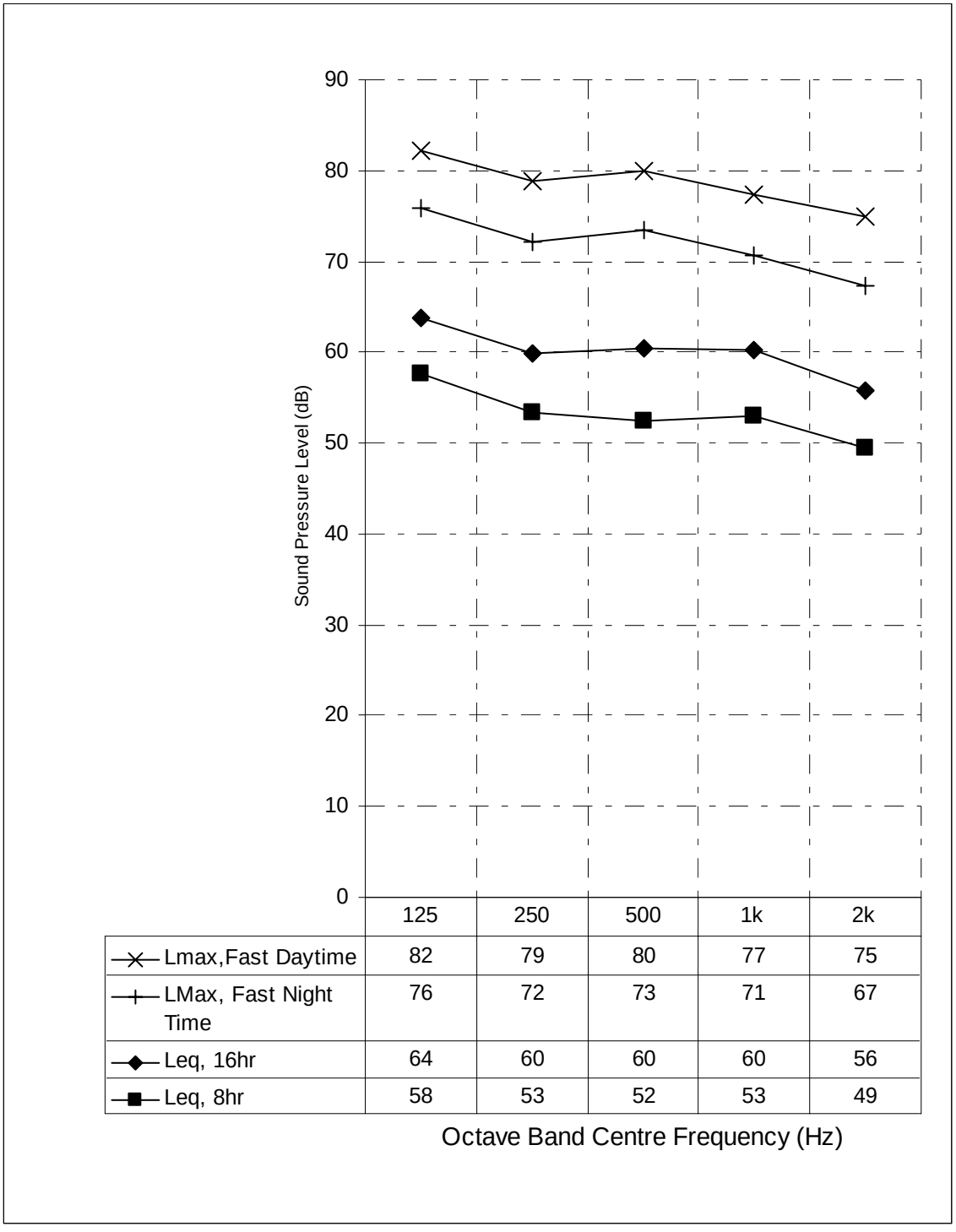


Figure 1044/ OB 1 : Octave Band Spectrum of Noise Exposure Levels at Position 1



	125	250	500	1k	2k
Lmax,Fast Daytime	82	79	80	77	75
LMax, Fast Night Time	76	72	73	71	67
Leq, 16hr	64	60	60	60	56
Leq, 8hr	58	53	52	53	49