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PROPOSED TRAVELODGE HOTEL EXTENSION
ST. GILES HOUSE, 1 DRURY LANE
LONDON WC2B 5RS

NOISE IMPACT ASSESSMENT
(INCORPORATING
PPG 24 NOISE ASSESSMENT)

Client: Parklake Limited and Travelodge Hotels Limited

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1.0 Introduction

1.1 It is proposed to redevelop the existing office building at 1 Drury Lane into a Travelodge Hotel. As part of the planning submission for the development, London Borough of Camden have requested a Noise Impact Assessment, containing information regarding two essential acoustic aspects, i.e. (i) confirmation that a suitable internal environment can be achieved for hotel residents, and (ii) confirmation that the potential level of noise impact caused by the development on its surroundings will be controlled to acceptable limits.

1.2 The brief for this Noise Impact Assessment is therefore as follows;

- Report on the results of an environmental noise level survey at the site.
- Review the requirements of PPG 24 Planning and Noise and relate to the proposed Travelodge, Drury Lane development.
- Establish existing levels of road traffic noise affecting the principal building facades, and determine relevant design data in accordance with the requirements of BS 8233 and Travelodge standards. Evaluate existing façade sound insulation performance, and advise any recommendations.
- Establish existing levels of background noise, and develop limits for plant noise emissions in order to comply with the relevant planning condition as issued by London Borough of Tower Hamlets. Assess the proposed plant in relation to this criteria, and advise on any attenuation requirements.

2.0 Site Description

2.1 The proposed Travelodge development is an existing un-used office building, located at the junction of Drury Lane and High Holborn.

2.2 The building has a concrete frame with steel framed double glazed windows, which it is intended to retain. The main part of the building has 11 storeys, with a smaller part of the building having 6 storeys.

2.3 High Holborn is a busy main road with high volumes of traffic, which dominates the ambient noise environment around the site. The building façade will need to provide sufficient sound insulation so as to address such noise in relation to internal noise level criteria.

2.4 There are existing residential properties around the site, in particular a student accommodation building for the London School of Economics, located on High Holborn immediately adjacent to the proposed development site. The rear of this building is shielded from road traffic noise, and constitutes the closest noise sensitive property for acoustic design purposes.

2.5 See figure 1 for a site plan.

3.0 Noise Survey Details

3.1 Location: Automated measurements were undertaken at three positions (A, B and C – see figure 1), with the microphones attached to an extension pole through open windows at positions 1 m from the building façade).

3.2 Instrumentation: Larson Davis type 820 and type 824 sound level meters, with Larson Davis type CA 250 calibrator. The instruments were calibrated immediately prior to the commencement of the survey, and upon completion. No calibration drift was recorded.

3.3 Period: Automated monitoring was performed continuously with noise levels measured in 15-minute intervals between Thursday 5th February 2009 and Monday 9th February 2009 – see data for actual time periods.

3.4 Weather: The prevailing weather condition over the survey period was dry and calm. Wind speed, although not recorded, was considered to be less than 5 m/s throughout the survey period.

3.5 Site Noise Characteristics: The ambient noise level at the site was dominated by road traffic noise from High Holborn and Drury Lane.

3.6 Surveyor: Bernard Templeman MIOA

3.7 Results: The results of the automated survey are presented in graphical format in figures 3, 4 and 5, showing the recorded values of $L_{Aeq,15min}$, $L_{A90,15min}$ and L_{Amax} as appropriate. See figure 6 for a glossary of terms.

4.0 PPG 24 Assessment

4.1 PPG 24 : Planning and Noise, sets out guidance to local authorities on means to limit the adverse effect of noise, and outlines considerations to be taken into account when determining planning applications, both for noise sensitive sites and for those activities which will generate noise. It also introduces the concept of noise exposure categories for residential development (i.e. housing), however these are not relevant to this project and will not be considered further.

4.2 Paragraph 12 of PPG 24 states "Local planning authorities should consider carefully in each case whether proposals for new noise-sensitive development would be incompatible with existing activities". In this context, the proposed development can be considered as sensitive to the possible intrusion to hotel bedrooms of road traffic noise from High Holborn and Drury Lane, and it will be necessary to demonstrate how this will be managed. This is addressed in section 5.0 of this report, including consideration of relevant internal noise criteria and means of mitigation.

4.3 Paragraph 10 of PPG 24 states "local planning authorities must ensure that development does not cause an unacceptable degree of disturbance". For the proposed development, the only activity considered to have potential to cause a noise impact on the local environment is the operation of proposed new roof plant serving the building. This will be considered in section 6.0 of this report, including reference to London Borough of Camden current planning policy requirements for plant noise control, along with suitable mitigation measures.

5.0 Assessment of Internal Noise Levels in Hotel Bedrooms

5.1 External Noise Level Assessment

5.1.1 Based upon the data shown in figures 3, 4 and 5, along with supplemental manual noise level measurements, the design values for external road traffic noise levels are considered to be as shown below. Note the L_{Amax} data shown are based upon an assessment of one minute interval data (not shown), in order to derive the "regularly occurring" value as opposed to absolute period maximum (as shown in the figures).

5.1.2 The design data are as follows;

Facade	Period / Index	octave band centre frequency (Hz)							dBA
		63	125	250	500	1k	2k	4k	
		sound pressure level, dB re $2x10^{-5}$ Pa							
High Holborn	Day $L_{Aeq,16hr}$	80	71	66	66	70	67	59	73
	Night $L_{Aeq,8hr}$	75	66	62	62	65	62	55	68
	Night L_{Amax}	91	80	79	77	77	75	70	81
Drury Lane	Day $L_{Aeq,16hr}$	77	70	67	66	69	68	60	73
	Night $L_{Aeq,8hr}$	75	67	65	64	66	64	57	70
	Night L_{Amax}	91	80	79	77	77	75	70	81
Rear (service road)	Day $L_{Aeq,16hr}$	68	63	60	58	57	55	48	62
	Night $L_{Aeq,8hr}$	66	61	58	56	55	53	46	60
	Night L_{Amax}	82	76	70	75	68	64	64	75

5.2 Existing Building Façade Sound Insulation Performance

5.2.1 External nose level data was gathered at position A in 15 minute intervals – this included recording of octave band noise level data. Internal noise level data was also gathered in an existing cell office behind the High Holborn façade at a position close to the external noise monitor (position D – see figure 1b). Measurements at position D were made in two 15 minute periods contiguous with those recorded at position A, i.e. between 15:30 to 16:00 on 2nd February 2009. In this way, the current noise level difference provided by the building façade can be determined. The relevant data is as follows (noise levels being log average of the two measurement periods);

Measurement	octave band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
	sound pressure level, dB re $2x10^{-5}$ Pa						
External	78	70	68	67	67	66	63
Internal	54	51	46	43	40	35	26
Difference	25	20	23	25	27	31	36

5.2.2 Based upon this information, and accounting for room reverberation time and façade area, the estimated façade sound insulation performance is as follows;

octave band centre frequency (Hz)						
63	125	250	500	1k	2k	4k
sound reduction index, R						
29	23	27	27	30	34	40

5.2.3 This performance is controlled by the existing windows, which comprise thermal double glazed units set into metal frames. Opening lights are hinged vertically, and do not include any frame seals.

5.3 Internal Noise Level Assessment

5.3.1 The design standards for acceptable internal hotel bedroom noise levels are set out by Travelodge. These standards are based upon the recommendations provided in BS 8233:1999, and have been found to provide an acceptable internal noise environment for Travelodge customers. The relevant criteria are as follows (this being an extract from the Travelodge standard acoustic specification);

BACKGROUND NOISE LEVELS – EXTERNAL SOURCES - TRAFFIC

THE BACKGROUND NOISE LEVEL IN ANY HOTEL BEDROOM WITH CLOSED WINDOWS AND OPEN TRICKLE VENTS, DUE TO EXTERNAL ROAD/RAIL/AIR TRAFFIC SOURCES, SHALL NOT EXCEED THE FOLLOWING.	
Period	Noise Level
Daytime (0700 -2300 hrs)	$L_{Aeq,16hour}$ 40 dB
Night-time (2300 - 0700 hrs)	$L_{Aeq,8hour}$ 35 dB $L_{Amax,F}$ 45 dB (1)
Notes: (1) For regular events only – excludes infrequent and irregular sources.	

5.3.2 Based upon the source noise level data shown in 5.1.2, and accounting for the existing building sound insulation performance shown in 5.2.2, the likely internal bedroom noise levels have been estimated as follows;

Facade	Period / Index	Prediction (dBA)
High Holborn	Day $L_{Aeq,16hr}$	46
	Night $L_{Aeq,8hr}$	41
	Night L_{Amax}	54
Drury Lane	Day $L_{Aeq,16hr}$	46
	Night $L_{Aeq,8hr}$	43
	Night L_{Amax}	54
Rear (service road)	Day $L_{Aeq,16hr}$	35
	Night $L_{Aeq,8hr}$	33
	Night L_{Amax}	48

5.3.3 The predicted internal noise levels are in excess of the relevant criteria in almost every case, and it will therefore be necessary to introduce mitigation measures to control noise ingress. It is also noted these predictions apply to rooms with the existing windows closed, thereby allowing no means of natural room ventilation – this must also be taken into account in any mitigation proposal.

5.4 Mitigation

5.4.1 The internal arrangement of the building means that cross-wall partitions between bedrooms will abut the existing window mullions, thereby causing each half of the window to be in adjacent rooms. In order to overcome the inherent weakness of the junction between window mullion and partition (such that appropriate internal sound insulation standards can be achieved, in accordance with the Building Regulations, Approved Document E), it is proposed to introduce a secondary glazing system with integral bulkhead plus natural ventilation path.

5.4.2 The secondary glazing system will be selected to achieve a sound insulation performance of not less than R_w 30 dB (in isolation), and the natural ventilation path will be attenuated to achieve a commensurate level of performance. This arrangement, along with the construction of the fixed bulkhead, is subject to detail design development, and will ensure the necessary internal noise levels are achieved. The attainment of these levels is an absolute requirement of Travelodge to take occupation of the building.

6.0 Assessment of Plant Noise Impact on Local Environment

6.1 Planning Requirements

6.1.1 Planning consents issued by London Borough of Camden generally include condition(s) which relate to noise and vibration issues. At time of writing, the standard condition which is considered likely to apply to this development is as follows;

Noise levels at a point 1 m external to sensitive facades shall be at least 5 dBA less than the existing background measurement (L_{A90}) expressed in dBA when ALL plant/equipment are in operation. Where it is anticipated that any plant/equipment 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) special attenuation should be given to reducing the noise levels from that piece of plant/equipment at any sensitive façade to at least 10 dBA below the L_{A90}, expressed in dBA. The applicant is therefore required to undertake a full acoustic background noise assessment, the full details of which shall be submitted to the Council, in order that the design criteria for the acoustic enclosure of plant/equipment can be properly assessed.

For each of the octave band of centre frequencies 63Hz-8kHz inclusive, noise levels from ALL plant/equipment (measured in L_{Aeq}) when in operation shall at all times add not more than 1 decibel to the existing background nose level L_{A90}, expressed in dBA, in the same octave band as measured 1 metre external to sensitive facades.

6.1.2 Limiting noise level criteria for new plant will be considered here in three distinct periods, related to the probable operating periods of the plant; i.e. daytime (08:00 to 19:00), evening (19:00 to 23:00) and night-time (23:00 to 08:00) hours.

6.2 Environmental Noise Level Criteria : Building Services Plant and Equipment

6.2.1 The typical lowest value of background noise level ($L_{A90,15min}$) measured over the three assessment periods are as follows

Period	Minimum Background Noise Level
Daytime (08:00 to 19:00)	$L_{A90,15min}$ 52 dB
Evening (19:00 to 23:00)	$L_{A90,15min}$ 51 dB
Night-time (23:00 to 08:00)	$L_{A90,15min}$ 47 dB

6.2.2 To comply with the likely planning requirements, the residual plant noise level must be at least 5 dB lower than these background noise levels, and the appropriate limits are therefore as shown below;

Period	Maximum Plant Noise Level
Daytime (08:00 to 19:00)	L_{Aeq} 47 dB
Evening (19:00 to 23:00)	L_{Aeq} 46 dB
Night-time (23:00 to 08:00)	L_{Aeq} 42 dB

6.2.3 If the proposed plant is likely to emit any distinguishable, discrete continuous notes (whine, hiss, screech, hum), or possess any distinct impulses (bangs, clicks, clatters, thumps), then the values of L_{Aeq} shown above must be reduced by 5 dB.

6.2.4 The representative octave band sound pressure levels associated with the overall noise levels in the table above are as follows;

Period	octave band centre frequency (Hz							
	63	125	250	500	1k	2k	4k	8k
	L_{90} sound pressure level, dB re $2x10^{-5}$ Pa							
08:00 – 19:00	59	57	53	51	48	43	37	33
19:00 – 23:00	58	56	52	50	47	42	36	32
23:00 – 08:00	54	52	48	46	43	38	32	28

6.2.5 To comply with the likely planning requirements, the spectra shown above must be increased by no more than 1 dB in any octave band by the new plant, assessed as the value of L_{eq}. In practice, this means that the value of L_{eq} per octave shall be at least 5 dB less than the value of L_{90}.

6.2.6 In order to achieve the requirements of London Borough of Camden, the residual plant noise level at 1 m from the nearest affected sensitive façade should be no more than that shown below;

Period	octave band centre frequency (Hz							
	63	125	250	500	1k	2k	4k	8k
	L_{eq} sound pressure level, dB re $2x10^{-5}$ Pa							
08:00 – 19:00	54	52	48	46	43	38	32	28
19:00 – 23:00	53	51	47	45	42	37	31	27
23:00 – 08:00	49	47	43	41	38	33	27	23

6.3 Plant Noise Assessment

6.3.1 The proposed plant will be located in the rooftop plantroom, with air intake/exhaust via louvres in the sloping face of the plantroom structure. The nearest potentially affected noise sensitive façade is considered to be the residential building overlooking the rear of the site (the LSE student accommodation block), as shown in figure 2.

6.3.2 The list of plant, and its relationship with the nearest noise sensitive property, is detailed below:

Plant	Distance and disposition
Swegon Gold CX air handling unit	~25.0 m, no line of sight

6.3.3 The noise levels published by the manufacturers for the proposed plant are as shown below:

Swegon Gold CX air handling unit	octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
	sound power level, L_w, dB re 10^{-12} W							
To outlet duct	76	71	78	83	82	82	81	67
To inlet duct	72	70	79	72	61	62	50	45

6.3.4 Noise level calculations have been performed using recognised standard procedures and formulae for noise propagation outdoors, based upon the source noise level data shown, and the proposed plant location and ductwork arrangement. It should be noted that there is an acoustic path difference greater than achieved by line of sight difference, between the residential facades and proposed plant location, due to the screening effect of the rooftop location; however, this effect will be partly negated due to acoustic reflections from the façade of the building.

6.3.5 The calculation process is summarised as follows;

	octave band centre frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A
L_w : outlet duct	76	71	78	83	82	82	81	67	
L_w : inlet duct	72	70	79	72	61	62	50	45	
Total effective L_w	77	74	82	83	82	82	81	67	
Duct losses, inc TER	-8	-7	-7	-10	-12	-12	-14	-16	
Distance attenuation : r = 25 m	-35	-35	-35	-35	-35	-35	-35	-35	
Directivity: 130°	0	-1	-3	-4	-5	-7	-8	-9	
Screening loss (δ=0.01 m)	-5	-6	-6	-6	-7	-8	-8	-9	
Source façade reflections	+3	+3	+3	+3	+3	+3	+3	+3	
Lp receive	32	28	34	31	26	23	19	1	32

6.4 Comparison of Plant Noise to Criteria

6.4.1 The first part of the likely planning condition requires the total plant noise level to be at least 5 dBA less than the prevailing background noise level (L_{A90}), or 10 dB less if the plant noise is tonal etc.

6.4.2 The comparative assessment of predicted plant noise in relation to the time related criteria is shown below;

	Period		
	08:00 – 19:00	**19:00 – 23:00**	**23:00 – 08:00**
Criteria (L_{Aeq})	47	46	42
Plant noise level (L_{Aeq})	32	32	32
DIFFERENCE	-15	-14	-10

6.4.3 This comparative assessment demonstrates that the predicted A-weighted noise level of the proposed plant will comply with the planning criteria for all time periods.

6.4.4 N.B. It is not considered that the plant will exhibit any distinguishable, discrete continuous note (whine, hiss, screech, hum) or distinct impulses (bangs, clicks, clatters, thumps) – as such, there is no need to apply a further 5 dBA penalty.

6.4.5 The second part of the likely planning condition will require the individual octave band plant noise levels to cause an increase in the background octave band noise levels of no more than 1 dB. In practice, this means that each individual octave band plant noise level must be at least 5 dB less than the prevailing background noise level.

6.4.6 A comparison of the predicted total plant noise levels with the target noise levels shown in table 4, for the three time periods, is shown in the following;

Comparison of predicted plant noise to criteria (daytime)

	octave band centre frequency (Hz)							
08:00 – 19:00	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Criteria	54	52	48	46	43	38	32	28
Predicted plant noise	32	28	34	31	26	23	19	1
DIFFERENCE	-22	-24	-14	-15	-17	-15	-13	-27

Comparison of predicted plant noise to criteria (evening)

	octave band centre frequency (Hz)							
19:00 – 23:00	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Criteria	53	51	47	45	42	37	31	27
Predicted plant noise	32	28	34	31	26	23	19	1
DIFFERENCE	-21	-23	-13	-14	-16	-14	-12	-26

Comparison of predicted plant noise to criteria (night-time)

	octave band centre frequency (Hz)							
23:00 – 08:00	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Criteria	49	47	43	41	38	33	27	23
Predicted plant noise	32	28	34	31	26	23	19	1
DIFFERENCE	-17	-19	-9	-10	-12	-10	-8	-22

6.4.7 The tables above demonstrate that the predicted octave band noise levels will comply with the planning noise criteria for operation over 24 hour periods.

7.0 Conclusion

7.1 This Noise Impact Assessment, has revealed the following, in relation to the guidance of PPG 24;

7.1.1 Issue : Paragraph 12 of PPG 24, states "Local planning authorities should consider carefully in each case whether proposals for new noise-sensitive development would be incompatible with existing activities".

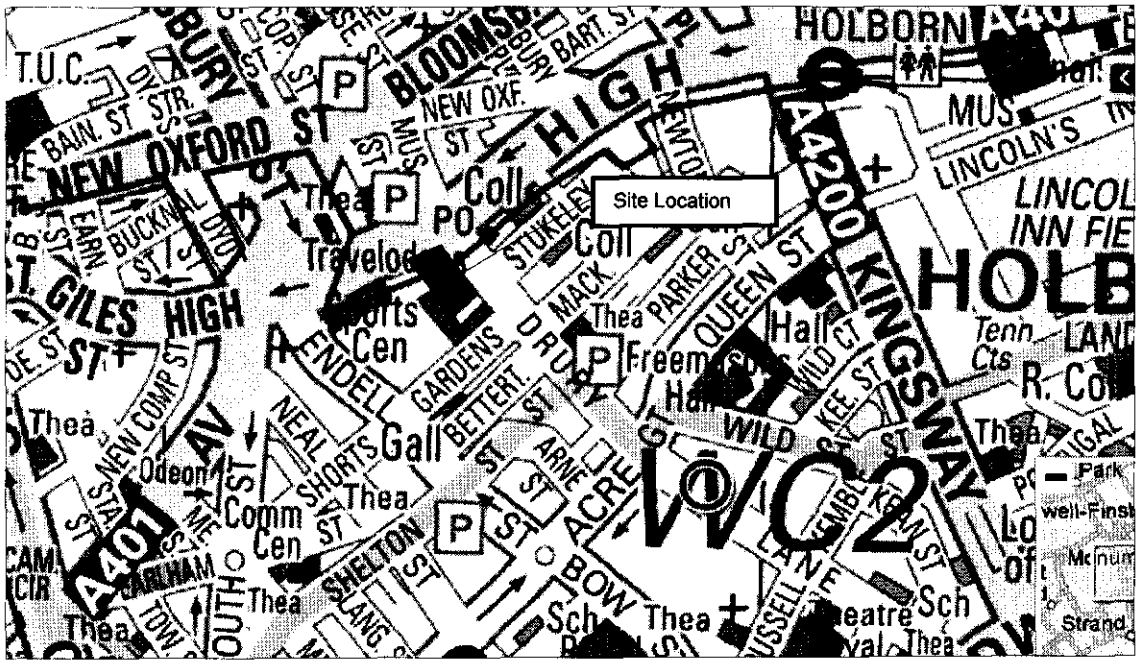
Response : In order to achieve acceptable internal hotel bedroom noise levels as a consequence of external road traffic noise levels, it will be necessary to include a scheme of secondary acoustic glazing with an attenuated ventilation path. The current design proposals are under development, however, they will be developed on this basis, and will be specified to ensure the appropriate Travelodge room noise level criteria are achieved.

7.1.2 Issue : Paragraph 10 of PPG 24 states "local planning authorities must ensure that development does not cause an unacceptable degree of disturbance".

Response : For the proposed development, the only activity considered likely to cause a noise impact on the local environment is the operation of proposed new roof plant serving the building. This has been reviewed in relation to the current planning policy requirements of London Borough of Camden, and it can be concluded the current plant proposals are acceptable for operation over 24 hour periods, and no additional noise mitigation measures are required.

Figure 1: Site Plan

1a : Site Location



1b : Measurement Positions

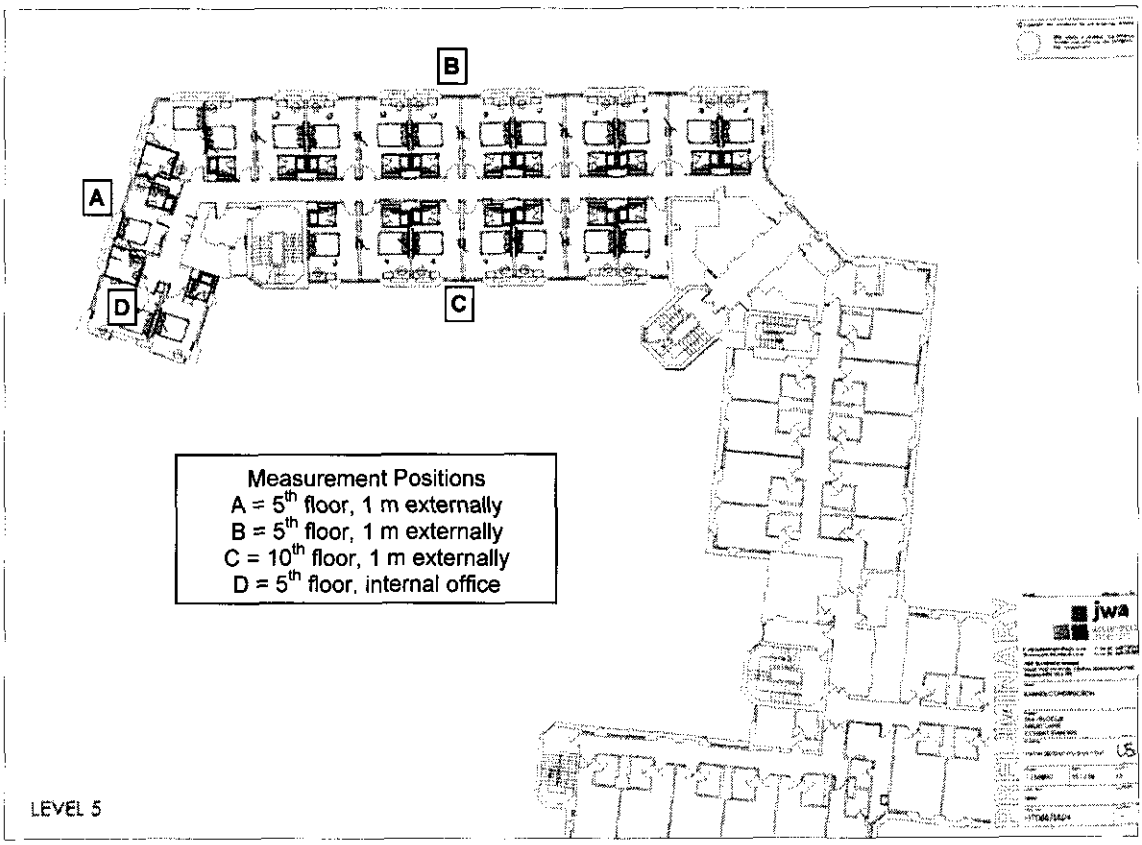


Figure 2 : Plant Location

Building Plan showing Plant Location and Closest Noise Sensitive Facade

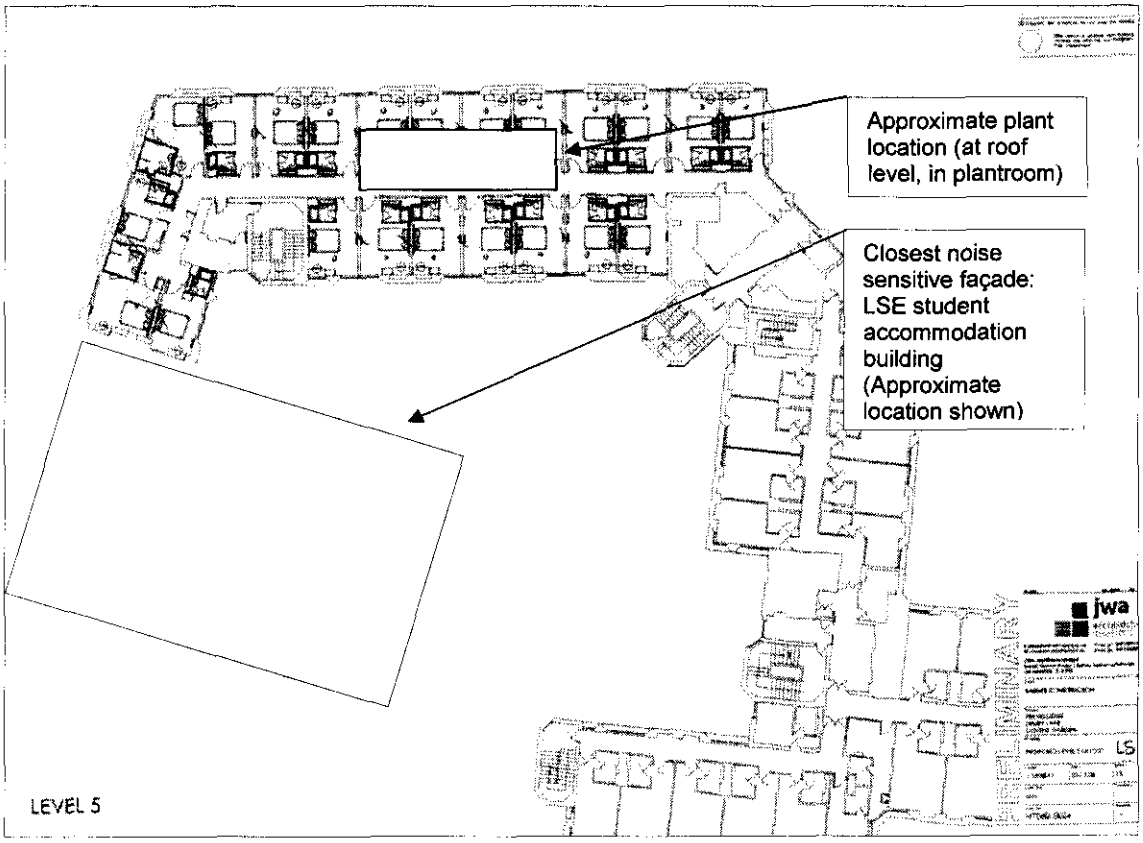


Figure 3: Survey Data – Position A

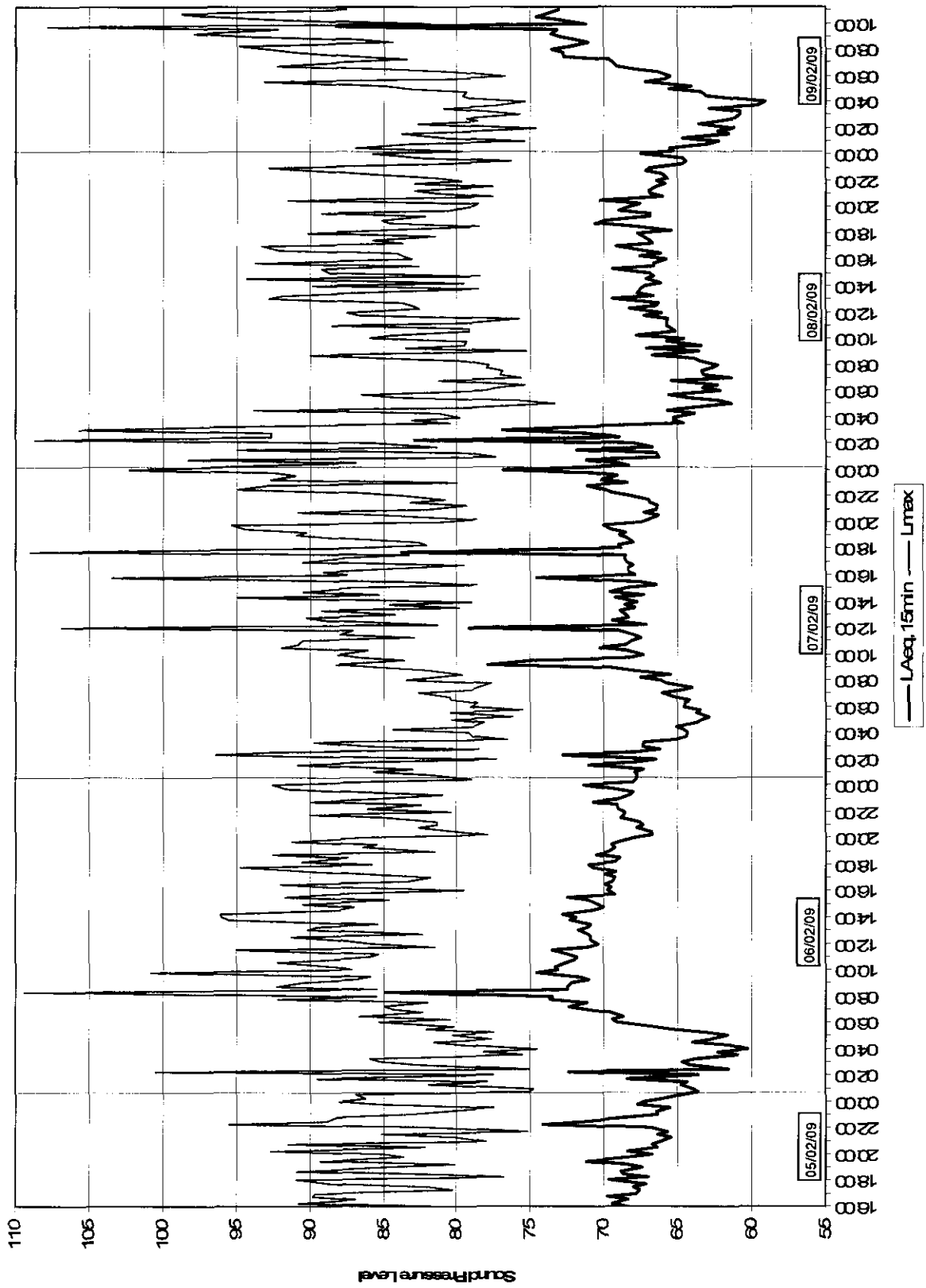


Figure 4: Survey Data – Position B

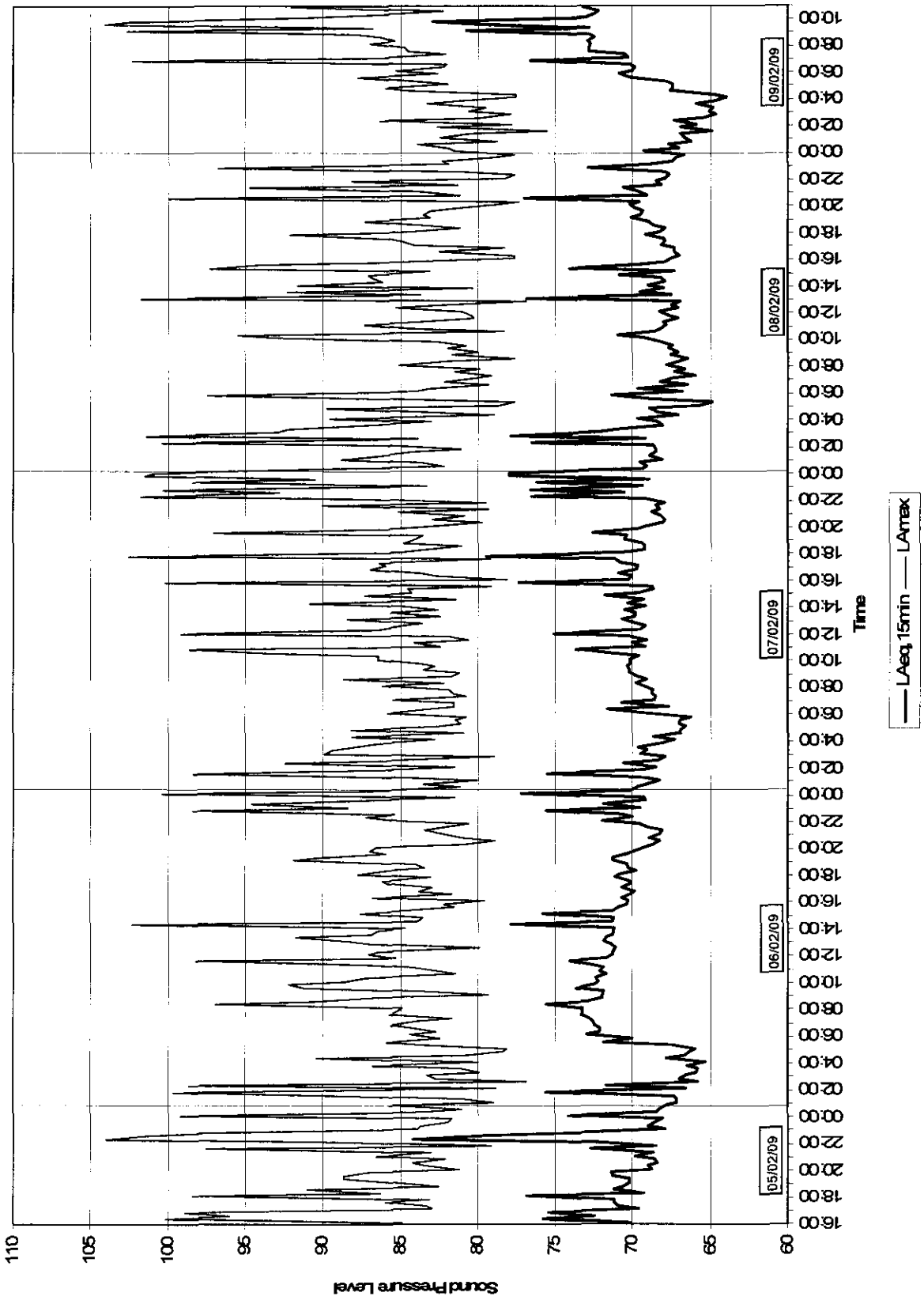


Figure 5: Survey Data – Position C

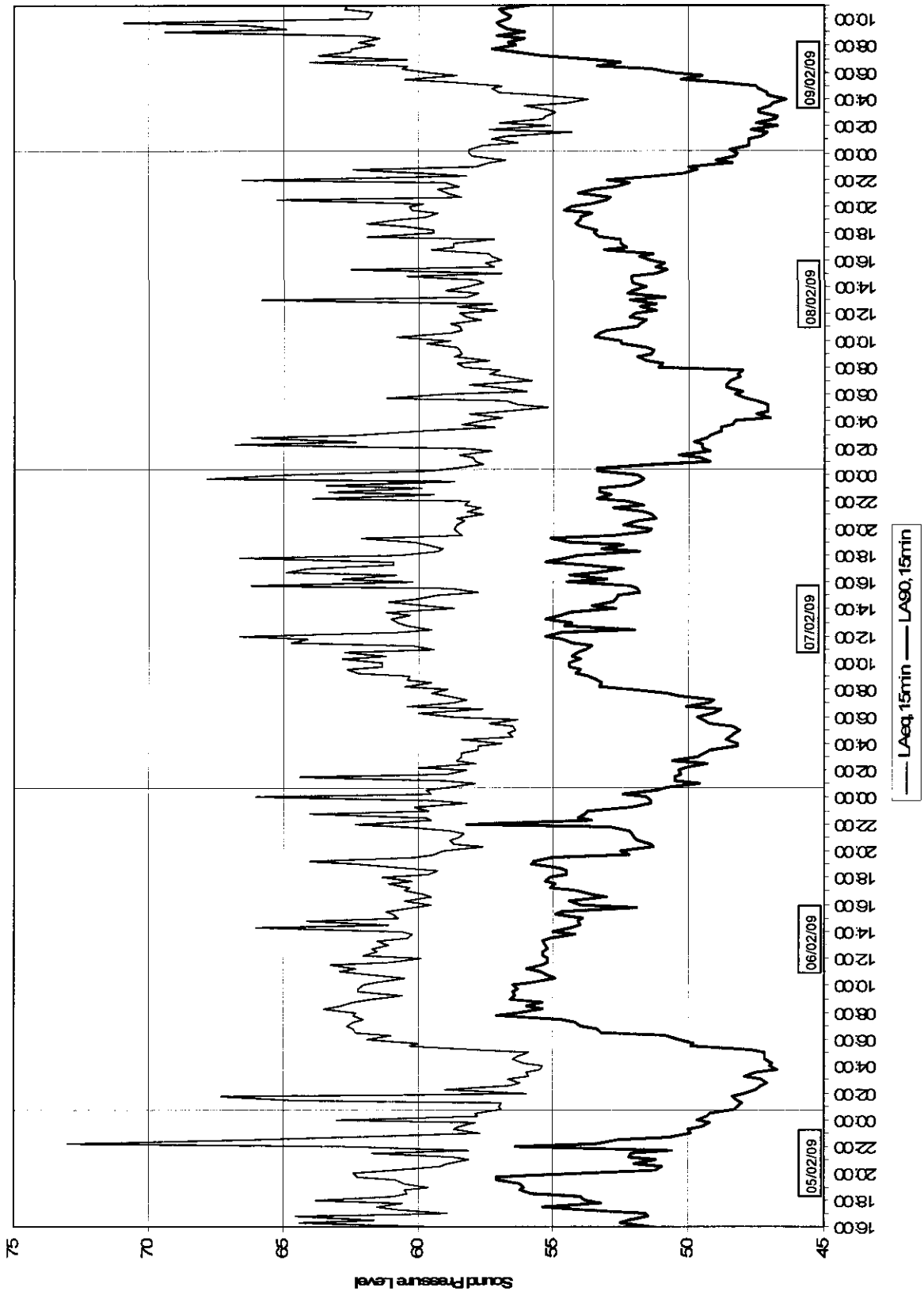


Figure 6: Glossary of Terms

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (Lp) the reference quantity is $2x10^{-5}$ N/m^2. The sound pressure level existing when microphone measured pressure is $2x10^{-5}$ N/m^2 is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (Lp) or Sound Power Level (Lw).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A weighting	Arithmetic corrections applied to values of Lp according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of Lp actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of Lp actually measured.
$L_{n,T}$	Lp which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during time, T.
$L_{Amax,T}$	The instantaneous maximum A weighted sound pressure level which occurred during time, T.
Background Noise Level	The value of $L_{A90,T}$, ref. BS4142:1997.
Traffic Noise Level	The value of $L_{A10,T}$.
Specific Noise Level	The value of $L_{Aeq,T}$ at the assessment position produced by the specific noise source, ref. BS4142:1997.
Rating Level	The specific noise level, corrected to account for any characteristic features of the noise, by adding a 5 dBA penalty for any tonal, impulsive or irregular qualities, ref. BS4142:1997.
Specific Noise Source	The noise source under consideration when assessing the likelihood of complaint.