Holbrook House, Holborn

WSP Buildings Ltd.

07 February 2005

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1 Introduction

1.1.1 Holbrook House is a 13 storey office block that lies in the Holborn area of Central London. The office block is bounded by Parker Street to the North and Great Queen Street to the South and is located approximately 50 metres to the east of the main A4200 Kingsway Road. The building is currently occupied by a number of class B1 tenants.

1.1.2 Proposals are currently in progress to refurbish this building. As part of the refurbishment programme, it is proposed to undertake amendments to the intermediate floor slabs in order to accommodate raised floors and to add a new floor at the 9th floor, which is currently a roof plant area. The existing building services plant on the roof at this level will be removed and new plant installed in the plantroom at 13th floor level.

1.1.3 In order to ensure that the acoustic integrity of the floor structures may be maintained as a result of the remedial works, and that the ambient noise level on the roof at the 13th floor of the building due to the installation of new building services plant to this space is not significantly elevated, WSP Acoustics has been commissioned by WSP Buildings Ltd. to undertake an acoustic review of the refurbishment proposals.

1.1.4 This report presents the details of our site surveys and the results of our assessments and subsequent recommendations.

1.1.5 This report occasionally employs technical acoustic terminology and, in order to assist the reader, Appendix A presents a glossary of the acoustic terminology employed.

2 Suspended Floor Slabs

2.1 ACOUSTIC PERFORMANCE OF EXISTING FLOOR

2.1.1 It is understood that the existing suspended floors at Holbrook House are of the following construction:

- 50mm screed (1200-1500 kg/m^3)
- 254mm concrete (2400 kg/m^3) enclosing 203mm, 10mm thick, hollow clay blocks
- Suspended metal frame ceiling grid with lay-in mineral fibre tiles

2.1.2 In order to determine the acoustic performance of the above floor construction, a sound insulation test of the floor slab between the 7th and 8th floors was undertaken on Tuesday 2 February 2005. Tests were undertaken between unoccupied floor spaces in accordance with the measurement procedure according to BS EN ISO 140-4:1998.

2.1.3 Once completed, the results of the measurements were rated in accordance with BS EN ISO 717, Part 1: 1997 *"Acoustics – Rating of sound insulation in buildings and of building elements"*. This rating method enables a single figure performance value to be derived from the test results.

2.1.4 From this process, the acoustic performance of the floor slab between the 7th and 8th floors was found to be 51dB D_w. The detailed results of this test can be found in the result sheet in Appendix B.

2.2 PREDICTED PERFORMANCE OF AMENDED FLOOR

2.2.1 It is proposed to remove the 50mm floor screed from the floor construction in order that a raised floor may be fitted to accommodate information technology cabling and various M&E services.

2.2.2 Based upon the densities of the floor screed and base layer indicated in 2.1.1 above, an assessment has been undertaken to quantify the likely reduction in airborne sound insulation performance of the separating floors should the screed layer be removed.

2.2.3 The results of our assessment indicate that airborne sound insulation performance of the separating floor is likely to reduce by up to 4dB through the removal of the 50mm screed layer, resulting in a performance of approximately 47dB D_w.

2.2.4 This reduction may be slightly offset by the additional sound insulation performance introduced by the fitting of the raised floor. Notwithstanding this, however, given that the raised floor will not form a hermetically sealed layer, and that the floor in itself will be lightweight, this effect is considered to be nominal.

2.3 BRITISH STANDARD 8233: 1999 – "SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS – CODE OF PRACTICE"

2.3.1 The scope of this standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use.

2.3.2 With regards to the sound insulation between offices, the document states that, where privacy is important, a minimum acoustic performance of 48dB D_w should be achieved.

2.3.3 From paragraph 2.2.3 it can be seen that the predicted airborne sound insulation performance of the amended floor within Holbrook House falls short of the BS 8233 recommended level by around 1dB. Despite this, however, such a small shortfall would be subjectively imperceptible to the occupants of the building. In addition, a 1dB difference is well within sound insulation measurement and predictions tolerances.

2.3.4 Considering this and the fact that activity noise levels associated with class B1 tenancies of the floor spaces within Holbrook House will be relatively low, it is considered unlikely that the removal of the screed layer from the floor will introduce adverse sound insulation issues between floors.

3 Plant Noise Emission Limits

3.1 ENVIRONMENTAL NOISE MONITORING

3.1.1 In order that noise emission limits may be recommended for the new building services plant items to be installed on the 13th floor of the Holbrook House building, the currently prevailing background noise levels at this location need to be established.

3.1.2 As such, an environmental noise monitoring survey of the current ambient noise levels was undertaken on the 13th floor roof space during a typical 24 hour weekday period. The environmental noise survey commenced at approximately 19:00 hours on Tuesday 01 February 2005.

3.1.3 The measurement equipment used during the noise survey consisted of a 01dB SOLO type 1 sound level meter (serial number 10712) fitted with a Microtech Gefell GmbH MCE212 Condenser Microphone (serial number 39755) and 01dB-Stell PRE 21 S Preamplifier (S/N 11349). The sound level meter was fitted with a windshield during the survey period and was calibrated prior to and upon completion of the survey with a 01dB-Stell Cal 21 Sound Calibrator (S/N 01120240). No calibration drifts were found to have occurred.

3.1.4 The noise measurements were undertaken at the edge of the 13th floor roof at a location which was considered to be the lowest in terms of noise emission levels from existing building services plant on the roof. The microphone was located approximately 2m above the level of the 13th floor roof slab. The approximate measurement location can be seen in the plan in Appendix C.

3.1.5 Weather conditions throughout the survey remained dry, with wind speeds ranging from still to light. Such wind speeds were not considered to have adversely affected the measured results. The noise climate on the roof of the building was dominated by the operation of building services plant both from Holbrook House and from plant located on the roofs of nearby buildings.

3.1.6 The detailed results of the environmental noise monitoring survey, in terms of the L_{Aeq}, $L_{Amax(fast)}$, L_{A10} and L_{A90} parameters can be seen in the Time History Graphs in Appendix D. In summary, however, Table 1 below presents a summary of the daytime and night time averaged noise measurements.

Table 1 – Summary of Measured Environmental Noise Levels

Time Period	Summary of Measured Noise Levels (dB Re $2x10^{-5}$ Pa.)			
	L_{Aeq}	$L_{Amax, fast}$	L_{A10}	L_{A90}
Daytime (07:00 – 23:00)	58.4	87.0	60.4	55.3
Night time (23:00 – 07:00)	53.8	75.6	56.5	48.8

3.2 PLANT NOISE EMISSION LIMITS

3.2.1 Based upon the noise levels recorded on site as detailed above, noise emission limits may be recommended for the additional items of building services plant proposed to be located at 13th floor roof level.

3.2.2 During our site visit it was noted that, due to the height of the Holbrook House building at the 13th floor plant level, there are no noise sensitive properties in the near vicinity that require consideration in terms of protection from building services plant noise. In light of this, it is considered that noise emissions from future building services plant items to be located on this roof should not significantly elevate the existing noise

climate. This will ensure that noise intrusion to the internal office spaces within Holbrook House will not become an issue.

3.2.3 Based upon the above, it is recommended that noise emissions from new items of building services plant to be installed on this roof be controlled such that the existing daytime and night time L_{Aeq} ambient noise levels are not elevated by more than 3dB.

3.2.4 In order that this criterion may be achieved, it is recommended that total noise emissions from the new items of building services plant, when operating simultaneously at worse case duty, achieve the following daytime and night time plant noise emission limits:

Table 2 – Required Plant Noise Emission Limits

Time Period	Total Plant Noise Emission Limit @ Nearest Noise Sensitive Façade
Daytime (07:00 – 23:00)	58 dB L_{Aeq}
Night Time (23:00 – 07:00)	53 dB L_{Aeq}

3.2.5 It is recommended that these criteria be achieved at the extremities of the 13th floor roof.

3.2.6 It is important to note that, in order to achieve the required criteria, noise emissions from individual building services plant items will need to achieve a lower level than those indicated in Table 2 above. The exact noise emission requirement for each individual plant item will be dependant upon a number of factors, including (but not limited to):

- Period of operation,
- Noise content,
- Location on the building roof (i.e. distance, intervening obstacles etc.)

4 Conclusions

4.1.1 WSP Acoustics has been appointed to undertake an acoustic review of the proposed refurbishment of Holbrook House in Holborn, central London.

4.1.2 It is proposed to undertake amendments to the intermediate floor slabs in order to accommodate raised floors and to add a new floor at the 9th level, which is currently a roof plant area. The existing building services plant on the roof at this level will be removed and new plant installed in the plantroom at 13th floor level.

4.1.3 With regards to the amendments to the intermediate floor slabs, it is proposed to remove the 50mm screed topping layer from the floors to accommodate raised floors. Based upon the results of our site surveys and a subsequent assessment, it is considered that the current 51dB D_w sound insulation performance of the floor will be reduced by up to 4dB following removal of the screed layer, resulting in a slightly reduced performance of approximately 47dB D_w.

4.1.4 This level falls slightly short of the sound insulation performance recommended within the BS 8233 document of 48dB D_w. Despite this, however, such a small shortfall would be subjectively imperceptible to the occupants of the building.

4.1.5 Considering this and the fact that activity noise levels associated with class B1 tenancies of the floor spaces within Holbrook House will be relatively low, it is considered unlikely that the removal of the screed layer from the floor will introduce adverse sound insulation issues between floors.

4.1.6 With regards to the new building services plant to be located on the 13th floor roof level, environmental noise monitoring has been undertaken at this level in order to quantify the existing daytime and night time noise climate. Based upon this data, noise emission limits for new building services plant items at this level have been recommended in order that the existing noise climate is not significantly elevated.

4.1.7 The limitations to this report are presented in Appendix E.

Appendix A Glossary of Acoustic Terminology

TERMINOLOGY RELATING TO NOISE

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
$D_{nT,w}$	A single number quantity that characterises the airborne sound insulation between rooms. See BS EN ISO 717-1:1997
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.

Appendix B Floor Sound Insulation Test Results Sheet

Standardised Level Difference According to BS EN ISO 140-4:1998

Field Measurements of Airborne Sound Insulation Between Rooms

Client : WSP Buildings Ltd.

Date of Test : 02 February 2005

Operative : Martin Raisborough
Test Methodology : BS EN ISO 140-4:1998

Test Type : Airborne Party Floor
Source Room : 8th floor corridor
Receive Room : 7th floor corridor

Equipment Details : Solo Sound Level Meter (S/N 10712), JBL Loudspeaker 140 Watts (S/N J168-054538), Broadband Noise Generator

Construction Details & Test Arrangement :

50mm concrete screed (1200 kg/m3) on 254mm base slab enclosing 203mm (2400kg/m3) hollow clay beams (10mm thick). Suspended ceiling below formed of mf grid with mineral fibre tiles.

Source Room Volume: 34 m^3
Receive Room Volume: 34 m^3

Frequency, f (Hz)	D_{nT} (1/3 octave) dB
50	
63	
80	
100	41.7
125	47.7
160	47.0
200	43.4
250	43.3
315	46.7
400	48.4
500	50.4
630	43.9
800	51.5
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1250	60.4
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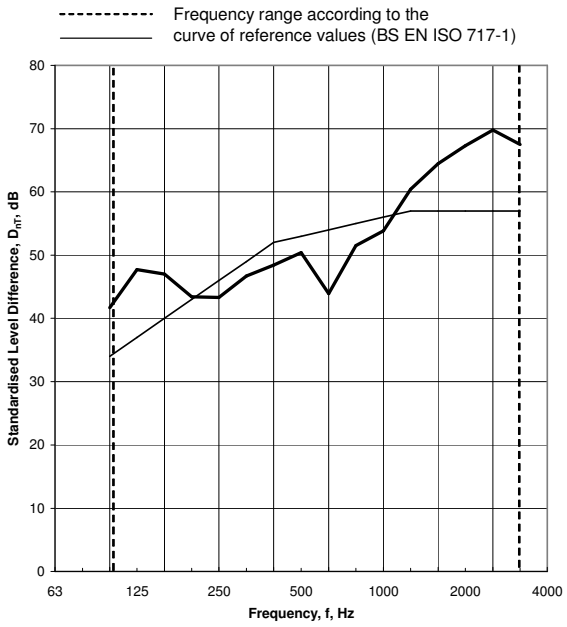
2000	67.3
2500	69.8
3150	67.5
4000	
5000	



Rating according to BS EN ISO 717-1 :

$D_{nT,w}$ ($C;C_{tr}$) = 53 (-1;-3) dB

Evaluation based on field measurement results obtained by an engineering method.

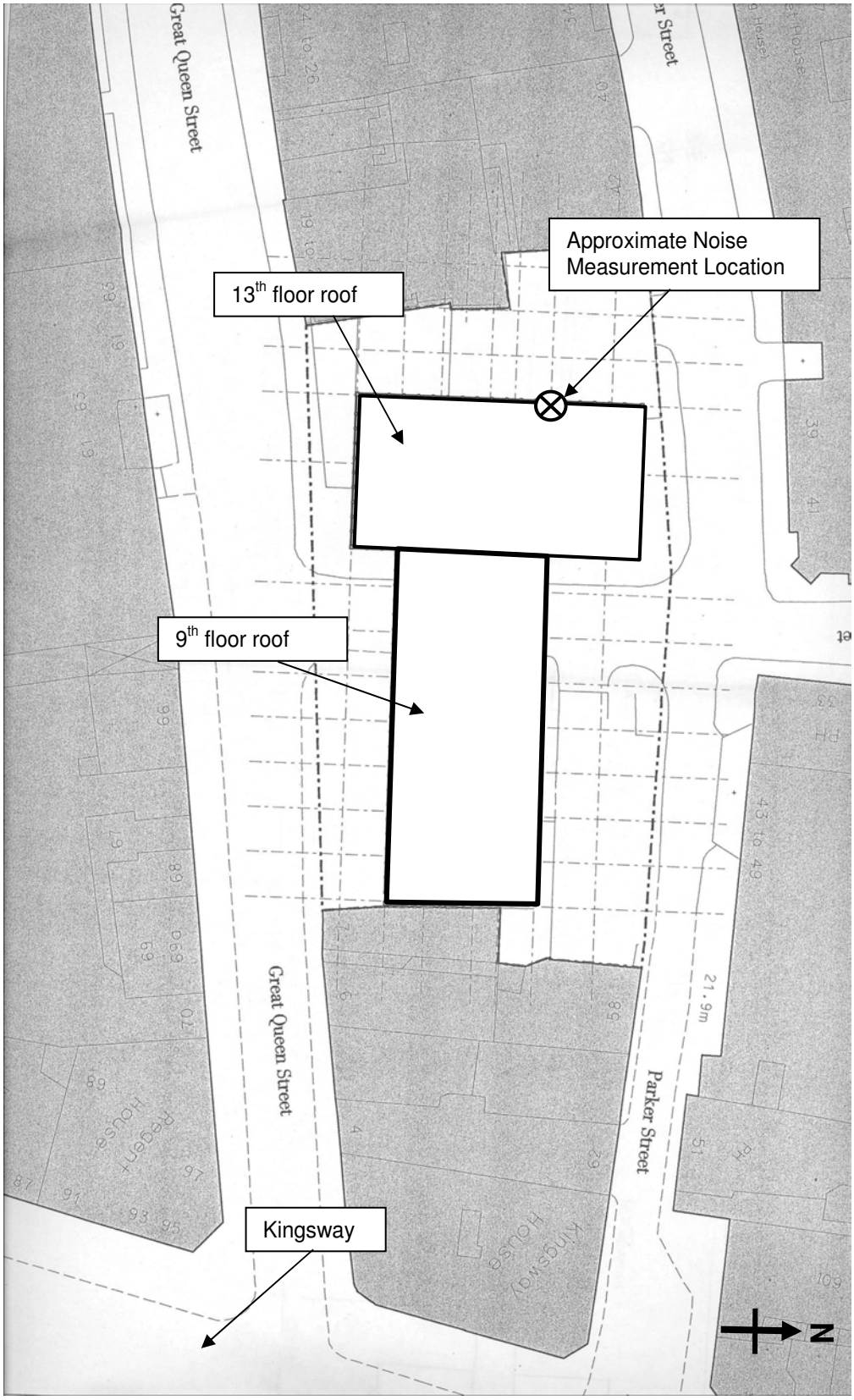
No. of test report : AF1

Name of test company : WSP Acoustics

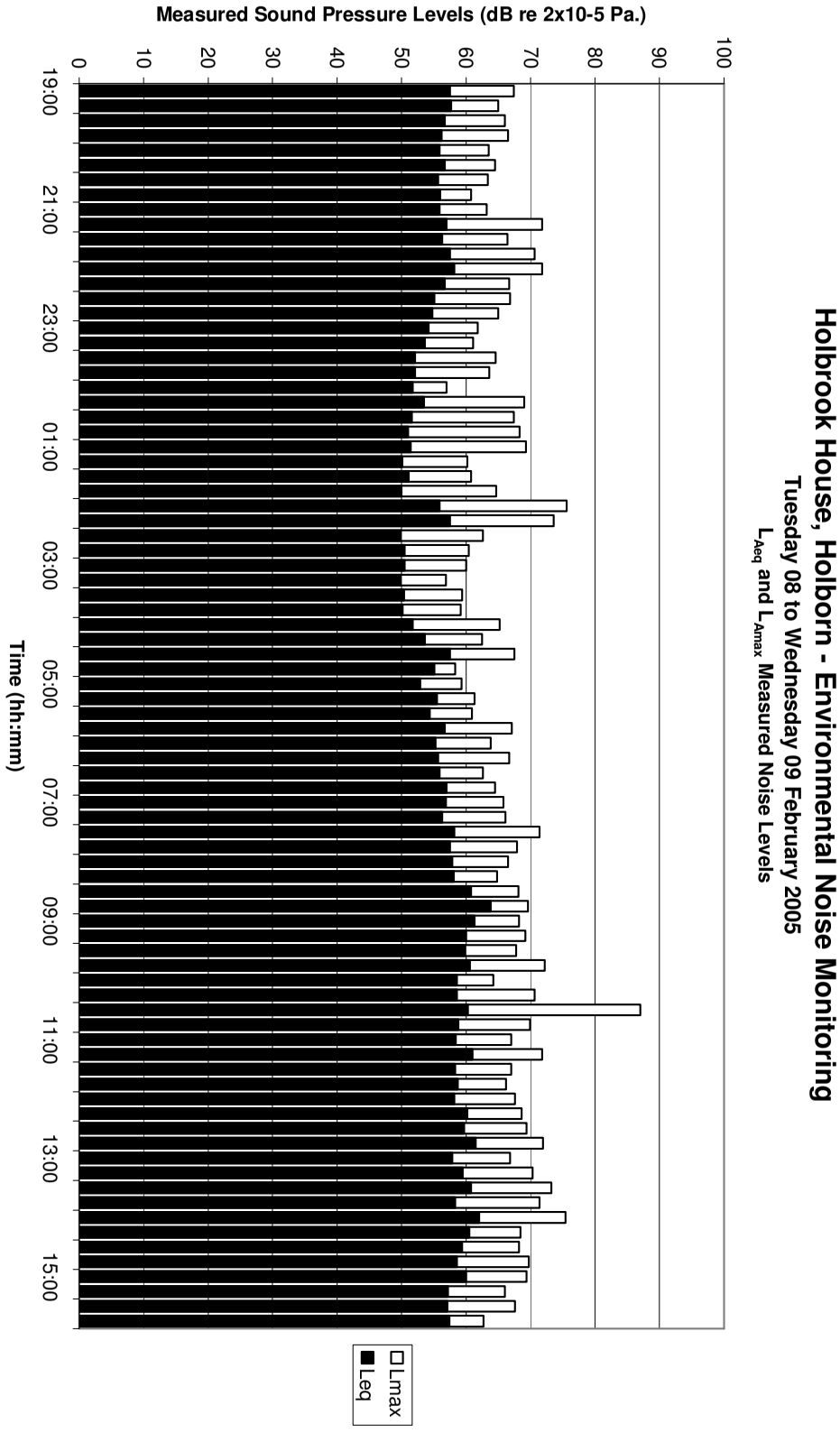
Date of Test Report : 07 February 2005

Signature :

Appendix C Plan Indicating Approximate Noise Measurement Location



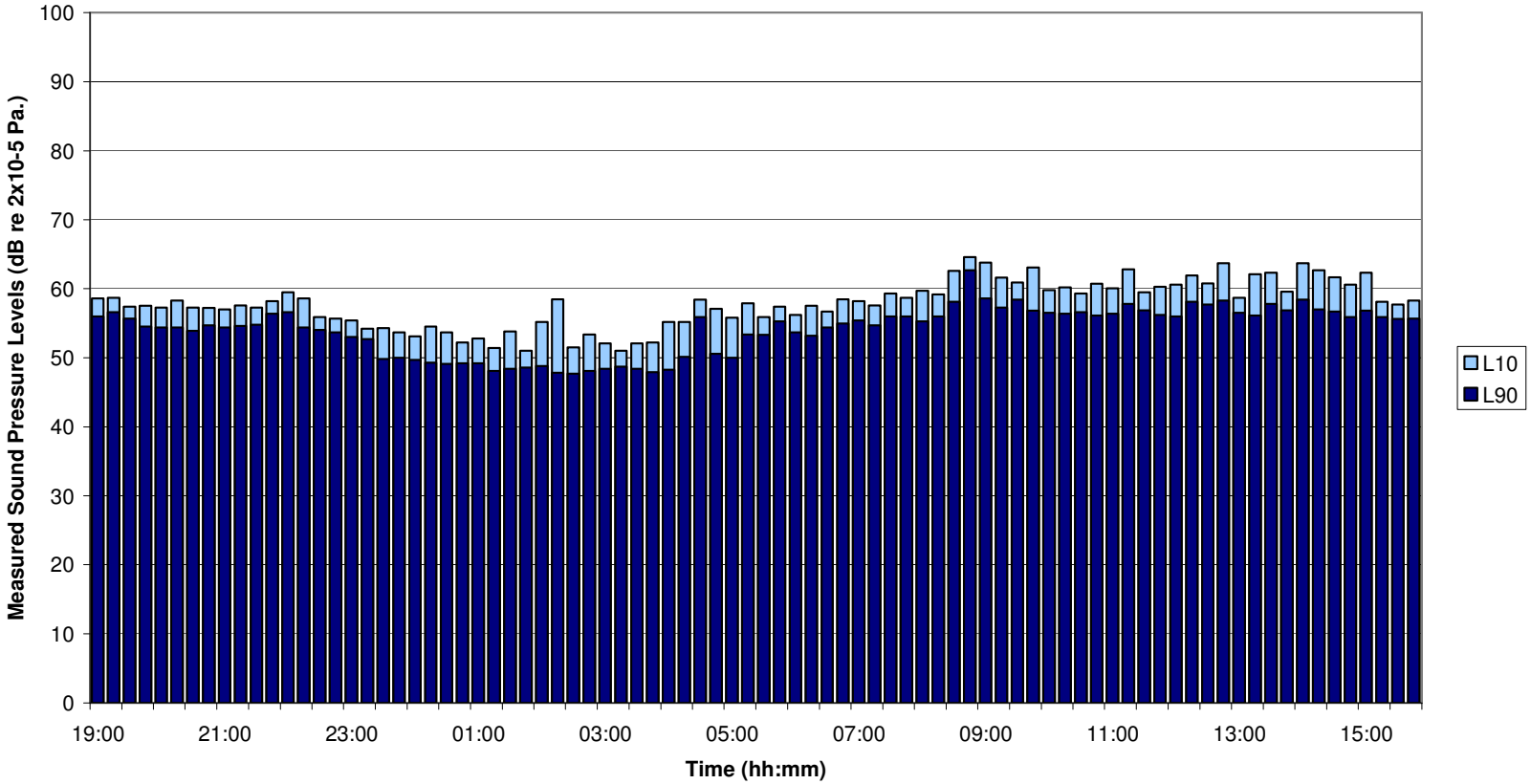
Appendix D Noise Measurement Results



Holbrook House, Holborn - Environmental Noise Monitoring

Tuesday 08 to Wednesday 09 February 2005

L_{A10} and L_{A90} Measured Noise Levels



Appendix E Limitations to this Report

NOTES ON LIMITATIONS

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The findings and opinions expressed are relevant to the dates of the site works and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations WSP Environmental Limited reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.