

Charlotte House, Manchester

ACOUSTIC ASSESSMENT REPORT 21284/AAR1/Rev2 (For Planning)

For:

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c/o OMI Architects
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DOCUMENT CONTROL

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AAR1 (0)	02/06/2015	Updated to consider design proposals & separating floors to satisfy Building Regulations	Andrew Jameson Director BSc(Hons), MIOA, MAES	-
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AAR1 (Rev2)	24/11/2015	Updated following receipt of EHO comments.	Andrew Jameson Director BSc(Hons), MIOA, MAES	-

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1.0 INTRODUCTION

It is proposed to redevelop Charlotte House on Charlotte Street in Manchester City Centre. The development will be a change of use from commercial to residential.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and assess the extent of acoustic treatment to make the building suitability for a residential material change of use.

This report presents our findings and recommendations.

2.0 OBJECTIVES

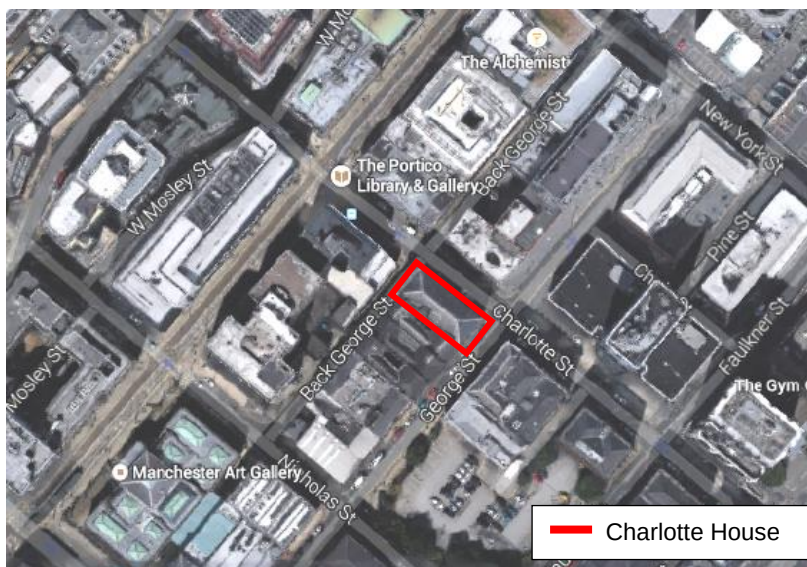
To establish the prevailing road traffic noise levels affecting the site by means of a detailed four day unmanned noise survey.

Based on the results of the survey, to assess traffic noise intrusion and advise on acoustic performance requirements for critical façade elements (namely glazing and ventilators).

To measure the airborne sound insulation performance of the existing floors and advise on the acoustic treatment of separating floors between proposed apartments and between the proposed restaurant unit and apartments.

3.0 SITE DESCRIPTION

Charlotte House is a listed building, located on Charlotte Street in Manchester and falls within the jurisdiction of Manchester City Council. The site is bound to the north by Charlotte Street and to the north-west by Back Georges Street and south-east by George Street. A site plan is shown below.



Site Plan (Imagery © 2014 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky, Landsat, May Data ©2014 Google.)

The building will comprise restaurant space at lower ground floor with residential apartments at upper ground floor and above.

4.0 ACOUSTIC TERMINOLOGY

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 ACOUSTIC STANDARDS & GUIDELINES

5.1 Noise Policy Statement for England

The Government's Noise Policy Statement for England (March 2010) sets out the long term vision for Government noise policy, which is to *"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development"*.

The NPSE includes three primary aims to be achieved through effective management of environmental, neighbour and neighbourhood noise; (1) avoid "significant adverse" impacts on health and quality of life, (2) mitigate and minimise "adverse" impacts on health and quality of life, and (3) where possible, contribute to the improvement of health and quality of life.

5.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF, March 2012) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

5.3 Suitable Internal Noise Levels

5.3.1 Local Authority Requirements

Manchester City Council (MCC) requirements are outlined in Section 3.9 of the GD 03 – Public Protection Information for Developers (Version: 1.01).

Section 3.9.1 sets out the following noise levels to be achieved for residential developments:

"BS 8233 and the World Health Organisation (WHO) have recommended specific limits for internal noise levels inside residential properties to allow appropriate living and sleeping conditions. MCC has adopted the following internal noise limits for residential properties:

- *Bedrooms (Night time - 23:00 to 07:00): 30dB LAeq and individual noise events should not normally exceed 45 dB (LAm_{ax}).*
- *Living Rooms (Day time 07:00 to 23:00): 40 dB (LAeq).*
- *Gardens/External Amenity Areas (Not applicable for City Centre developments and housing near busy roads): 55 dB (LAeq).*

Where it is necessary to keep windows closed to achieve the required internal noise levels it may be a requirement to provide additional mechanical ventilation to ensure that residential properties can be adequately ventilated if its occupants choose to keep their windows closed for noise reasons. Any ventilation will need to meet the requirements of Part F of the Building Regulations, which will be assessed by the Building Control Department. Where additional ventilation is required it should be capable of achieving the same noise reduction as the closed glazing and building structure.”

5.3.2 BS 8233: 2014

British Standard 8233:2014 “Sound insulation and noise reduction for buildings” recommends design criteria for internal ambient noise levels for dwellings. It states that it is desirable that internal ambient noise levels do not exceed the following guidelines:

Room Type	07:00-23:00 hrs	23:00-07:00 hrs
Living Rooms	35 dB $L_{Aeq,16hr}$	-
Bedrooms	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

The document goes on to state that the above target levels may be relaxed by 5dB and reasonable internal conditions would still be achieved.

5.3.3 Summary

Based on the above, we would propose the following internal acoustic design criteria for external noise intrusion.

Room Type	Period	Upper Limit
Living Areas	Daytime (07:00-23:00)	35 dB $L_{Aeq,16hr}$
Bedrooms	Night Time (23:00-07:00)	30 dB $L_{Aeq,8hr}$

5.4 Internal Sound Insulation

5.4.1 Building Regulations’ Approved Document E

The separating floors between adjacent apartments and between an apartment and another other part of the building (e.g. the restaurant) will need to satisfy the statutory requirements of Building Regulations’ Approved Document E (ADE): 2003 Edition.

In this instance, the building is of a historic nature with many listed finished that will need to be retained and exposed. This may limit the achievable sound insulation performance of separating elements and, in this regard, ADE states:

“In the case of some historic buildings undergoing a material change of use, it may not be practical to improve the sound insulation to the standards [of ADE]. The need to conserve the special characteristics of such historic buildings needs to be recognised, and in such work, the aim should be to improve sound insulation to the extent that it is practically possible, always provided that the work does not prejudice the character of the historic building, or increase the risk of long-term deterioration to the building fabric or fittings.”

In line with the above, the existing separating floors within the development shall be refurbished so as to *aim* (as far as practically possible) the following sound insulation targets.

Adjacency	Separating Floor Sound Insulation ‘Target’	
	Airborne Sound Insulation, $D_{nT,w} + C_{tr}$	Impact Sound Pressure Level, $L'_{nT,w}$
Apartment to Apartment	≥ 43 dB	≤ 64 dB
Restaurant/Common Area to Apartment	≥ 43 dB	N/A

5.4.2 Local Authority Requirements (Restaurant Noise Transfer)

MCC requirements are outlined in Section 3.9 of the GD 03 – Public Protection Information for Developers (Version: 1.01). Section 3.9.3 sets out the following guidance for mixed use developments:

“Where a planning application includes a proposal to contain a potentially noisy development within the same building as a noise sensitive use or visa versa the noise survey should consider the transfer of noise between the noisy and noise sensitive uses. An example of where this should be considered would be a proposal for a bar or club within the same building as residential properties. Consultants should demonstrate that the structure of the development will be sufficient to adequately contain the noise generated within the development. In doing so consultants should consider:

- *“Flanking” noise;*
- *“Structure borne” noise;*
- *The overall level of noise (LA_{eq}) generated by the use in question and any tonal or impulsive characteristics that the noise may contain; and*
- *The acoustic properties of the development (Including the construction of party floors and/or walls, windows and doors, ventilation systems, and structural columns”.*

Based on the above, we would suggest that in order to minimise the risk of complaints from the residents, noise from the operation of the restaurant should be designed so as to achieve a level 10 dB below the standard internal noise level criteria in apartments, as presented in the Section 5.3.3.

6.0 ENVIRONMENTAL NOISE SURVEY

6.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 10:30 hours on Wednesday 22 April 2015 to 14:30 hours on Monday 27 April 2015.

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However at the beginning and end of the survey period the wind conditions were calm and the sky was generally clear. We understand that generally throughout the survey period the weather conditions were similar to this with no prolonged periods of rainfall. These conditions can be considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the octave band and broadband A-weighted L_{Aeq} , L_{A90} and L_{Amax} sound pressure levels over 15-minute periods.

6.2 Measurement Positions

The noise level measurements were undertaken at two positions around the development site. The measurement positions are described in the table below and shown on the plan below.

Position No	Description
1	The sound level meter was located at 1 m from the northern façade of the existing building at Level 1 overlooking Charlotte Street.
2	The sound level meter was located at 1 m from the eastern façade of the existing building at Level 1 overlooking George Street.



Measurement Location

(Imagery © 2014 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky, Landsat, May Data ©2014 Google.)

6.3 Instrumentation

The instrumentation used during the survey is presented in the Table below:

Description	Manufacturer	Type	Serial Number	Latest Verification
Type 1 Data Logging Sound Level Meter	Larson Davis	824	3699	24/04/2014
Type 1 Data Logging Sound Level Meter	Larson Davis	824	3701	20/04/2015
Type 1 Calibrator	Larson Davis	CAL200	3083	20/04/2015

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the survey. No significant changes were found to have occurred (no more than 0.1 dB).

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. Each microphone was fitted with a Larson Davis windshield.

6.4 Results

The A-weighted L_{Aeq} , L_{A90} and L_{Amax} sound levels recorded throughout the duration of the survey are presented on the enclosed Time History Graphs 21284/TH1-TH2. The values are uncorrected façade-measured noise levels.

Upon installation/collection of the equipment, the noise climate was noted to be dominated by traffic on the surrounding roads.

7.0 INTERNAL NOISE LEVELS

7.1 Incident External Noise levels

Based on the results of our noise survey we have calculated 16-hour daytime and 8-hour night-time incident noise levels for each façade of the building. A correction has been applied in line with BS 8233 to obtain free-field values. The results are summarised below.

Facade	Incident Noise Levels (dB)	
	Daytime $L_{Aeq,16hr}$	Night-time $L_{Aeq,8hr}$
Charlotte Street	63	60
George Street & Back George Street	61	59

7.2 Achieving Internal Noise Limits

Provision exists to provide enhanced sound insulation of the building envelope as required. It is proposed that the external envelope of the residential units will incorporate suitably specified glazing and an appropriate ventilation strategy so as to achieve the standards outlined in Section 5.3.3.

It is understood that the air pollution around the site precludes the reliance of opening windows to draw fresh air into the building. A mechanical ventilation system is therefore proposed for habitable rooms in all apartments.

Consequently, the noise levels presented in Section 5.3.3 will need to be achieved by the combination of external noise intrusion and internal mechanical ventilation services. For the latter, we present appropriate noise rating (NR) design limits below.

Room	NR Limits for Mechanical Ventilation System (Boost)
Living room	NR30 (NR35)
Bedroom	NR25 (NR30)

We understand the existing windows are to be retained and consist of single glazed panels in sliding sash window frames. In order to satisfy the criteria outlined in Section 5.3.3, the glazing would need to be acoustically uprated to achieve the following minimum sound reduction performance.

Room	Minimum Sound Reduction Performance, R_w
Living Room Windows	29 dB
Bedroom Windows	34 dB

For living rooms, the above specification should be achievable with single glazed sash windows, provided the windows are refurbished to high standard, are defect free, and have compression seals so that the frames/glass is airtight when closed.

For Bedrooms, the existing sash windows alone would not provide sufficient sound reduction and secondary glazing would be required. The existing glazing would still need to be refurbished to a good airtight standard. The secondary glazing would need to be installed by a specialist supplier such as Selectaglaze (Tel: 01727 837371) or equal and approved. The system should comprise glass with a minimum thickness of 6 mm, contained in acoustically high performance frames. Any openable windows shall be of the casement type with multi point locking evenly compressing neoprene seals – not sliding. The frames shall be thoroughly sealed against solid masonry on all sides. The secondary glazing shall be separated from the primary glazing by an airspace of at least 100mm, and preferably more, so as to maximise the sound insulation. There shall be no ventilation openings through the windows.

Current design proposals indicate secondary glazing to both living rooms and bedrooms that are in line with the above suggested glazing specification. At upper ground floor, the void between the primary and secondary glazed panes is significantly greater than 100mm in order to retain existing shutters within the void.

Based on the above, acceptable internal noise levels should be comfortably achieved in all habitable rooms.

7.3 Summertime/Purge (Open Windows)

During the summer (or purge conditions), occupants may open windows during which time internal noise conditions would obviously be compromised.

With windows open, the sound insulation of the façade can be expected to be 20-25 dB (partially opened secondary glazing with staggered openings). Incident noise levels are, at worst 63 dB $L_{Aeq,16hr}$ during the day, so this would give 38-43 dB $L_{Aeq,16hr}$ within living rooms daytime (less in bedrooms night-time). Given the % times windows would need to be open over the course of a year, these conditions are considered to be reasonable.

However, if the Local Authority require BS 8233 internal noise levels to be maintained during these periods, the mechanical ventilation units will need to provide a boost duty to remove the need for occupants to open windows.

8.0 SEPARATING FLOORS

8.1 Assessment of Floors Against Building Regulations (ADE)

Hann Tucker Associates visited site on Wednesday 22 April 2015 to undertake an airborne sound insulation test across the existing separating floor between the lower ground and upper ground floor.

The floor was understood to comprise 35 mm thick timber floor boards on 200 mm joists (400 mm centres) on beams and plastered ceilings between beams. This construction is consistent throughout the building.

The test indicated the floor is currently achieving an airborne sound insulation performance of 35 dB $D_{nT,w} + C_{tr}$, which is 8 dB shy of ADE standards.

Impact sound pressure level tests were not undertaken, although the existing floor would be expected to significantly exceed the maximum targets without the inclusion of a resilient floor system/layer.

We would recommend the floors throughout are acoustically enhanced to approach ADE standards.

8.2 Assessment of Potential Restaurant Noise Transfer

Noise level measurements have previously been undertaken in a bustling modern restaurant within Manchester City Centre. The typical highest 1-hour noise levels are presented below.

Location	Reverberant Noise Level (dB $L_{eq,1hr}$) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Within Restaurant	61	64	68	72	69	65	60	53	73
Kitchen	69	66	69	74	72	69	65	60	76

NB Measurements undertaken during very busy Saturday evening service.

Based on the above figures, and the results of the airborne sound insulation test presented in Section 8.1, our calculations indicate restaurant noise would exceed ideal targets.

Hence, in order to approach ADE standards and avoid an adverse noise impact, the floor separating the restaurant/kitchen from apartments would need to be acoustically enhanced.

8.3 Recommendations

8.3.1 Appreciation for Historic Constraints

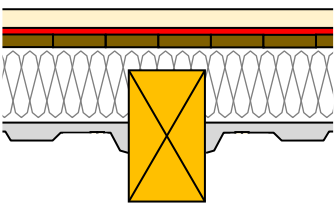
It is understood the underside of the existing separating floors cannot be underdrawn with plasterboard due to exposed historic finishes. This is with the exception of the lower ground floor (restaurant space), where there are no historic ceiling finishes.

We also understand that it is not possible to significantly increase finished floor levels without introducing steps and access/safety issues, as the historic staircase is to be retained.

Existing timber floorboards are to be retained and must be fixed to the joists for structural stability.

8.3.2 Upper Floor Construction (Apartment-to-Apartment)

Based on the above, we would propose the following 'best practical treatment' of the apartment-to-apartment floors, in order to approach the standards of ADE:-

Sketch	Specification
	Floor Treatment:- - Dense tongue-&-groove/well-sealed floorboards providing a minimum mass per unit area of 25 kg/m²; - Resilient layer providing a minimum change in impact sound pressure level, ΔL_w, of 15 dB when tested in accordance with BS EN ISO 140-8 and rated to BS EN ISO 717-2. <i>Example product: SRS Maxideck (28mm o.s.d)</i> Cavity Treatment:- - Mineral wool insulation with a density of 30-60 kg/m³.

8.3.3 Additional Restaurant Noise Control

Based on the restaurant/kitchen source noise levels presented in Section 8.2 and our predicted sound reduction performance of the the uprated acoustic floor presented in Section 8.3.2, our calculations indicate resultant noise levels within upper ground floor apartment living rooms over the restaurant demise may just exceed our proposed design targets. This would suggest further treatment would be required to ensure a noise nuisance is avoided.

Furthermore, current design proposals indicate secondary glazing to living rooms as well as bedrooms, thus background noise levels are likely to be very low making intermittent noises from the restaurant/kitchen more noticeable.

We would therefore recommend the floor separating restaurant/kitchen from apartments is specified as per Section 8.3.2 and restaurant/kitchen spaces include an additional plasterboard ceiling.

This ceiling should comprise:-

- 1 x 15mm SoundBloc (or equivalent and equally approved);
- Supported on lightweight metal frame or timber battens providing a minimum 50mm void;
- 25mm (min) mineral wool quilt within the void (15-60kg/m³).

9.0 RESTAURANT NOISE BREAKOUT ASSESSMENT

Noise generated by the operation of the restaurant unit should not unduly impact on the locality and occupants of neighbouring buildings. To this end, we would suggest L_{eq} operational noise levels should not exceed the a level 5dB below the lowest daytime L_{eq} noise levels (per octave band) at the façade of the opposite/adjacent buildings (approximately 10 metres away). This will ensure any potential increase in noise has a negligible subjective impact in accordance with Institute of Acoustics' guidelines on change in noise levels.

Noise level measurements have previously been undertaken in the table areas of a bustling modern restaurant within Manchester City Centre, as discussed in Section 8.2.

The external building fabric will comprise existing masonry walls with punched-in windows which we have pessimistically assumed would provide a minimum sound reduction of 30 dB R_w .

Based on the above data, current OMI Architects drawings, and a typical spectral shape for single glazed windows, our noise calculation is presented below.

Location	Noise Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Source Level	61	64	68	72	69	65	60	53	73
<i>Window Sound Reduction</i>	-15	-20	-22	-26	-30	-33	-30	-30	-
<i>+10log(S/r²), 10m</i>	-6	-6	-6	-6	-6	-6	-6	-6	-
<i>-14</i>	-14	-14	-14	-14	-14	-14	-14	-14	-
Noise at Receptor	26	24	26	26	19	12	10	3	26

The resultant noise level at the nearest building façade is expected to be less than 30 dB L_{Aeq} which is significantly below the daytime (or night-time) ambient and background noise levels measured during our baseline noise survey. Hence, no adverse noise impact is expected.

Entrance doors to the restaurant should be lobbied with one of the door sets having acoustic seals to achieve an overall sound reduction of 30 dB R_w . There should no need for the inclusion of sound limiters within the restaurant, unless the tenant intends to have live music or loud amplified DJs. In which case, we would suggest this section of the report is amended to form acoustic requirements for inclusion in the tenant's handbook. We would be pleased to undertake this exercise if required and upon request.

10.0 CONCLUSION

A detailed environmental noise survey has been undertaken in order to establish the prevailing road traffic noise climate on site.

The acoustic requirements of national/local policies and current industry guidelines have been reviewed and used to inform an assessment of road traffic noise affecting the proposed residential properties.

Our assessment indicates the design proposals for refurbished existing sash windows and secondary glazing to habitable rooms and a whole-house mechanical ventilation strategy to apartments should achieve acceptable internal noise levels.

An assessment of separating floor constructions between apartments and between the restaurant demise and apartments has been undertaken. A best practical solution has been proposed with the aim of approaching Building Regulations Approved Document E standards. Our solution comprises a dense proprietary resilient floor system and the introduction of cavity floor insulation. For the restaurant demise, we have recommended an additional plasterboard ceiling to control noise transfer to apartments above.



Andrew Jameson
Director
HANN TUCKER ASSOCIATES

Appendix A – Acoustic Terminology

The acoustic terms used in this report are as follows:

dB : Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.

dBA : The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dBA level.

Because of being a logarithmic scale noise levels in dBA do not have a linear relationship to each other. For similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

L₁₀ & L₉₀: If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L₉₀ is the average minimum level and is often used to describe the background noise.

It is common practice to use the L₁₀ index to describe traffic noise, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.

L_{eq} : The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise.

L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 1 hour).

The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.

L_{max} : L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level

Example Noise Intrusion Calculation

Bedroom / Night-time L_{eq}

EBF Calculation (road traffic noise intrusion)

		dB			
external noise level (free-field)		60	dB		
	index	dB	size/no.		
wall	Rw	45		5	m2
glazing	Rw	34		4	m2
roof	Rw	45		11	m2
vent	D,n,e,w	40		1	No.
room	w/	3	l/	3.5	h/
reverberation	T (s)	0.5			2.2

< glazing spec (min)

< mech ventilation (40dB+)

Internal noise level **29** dB

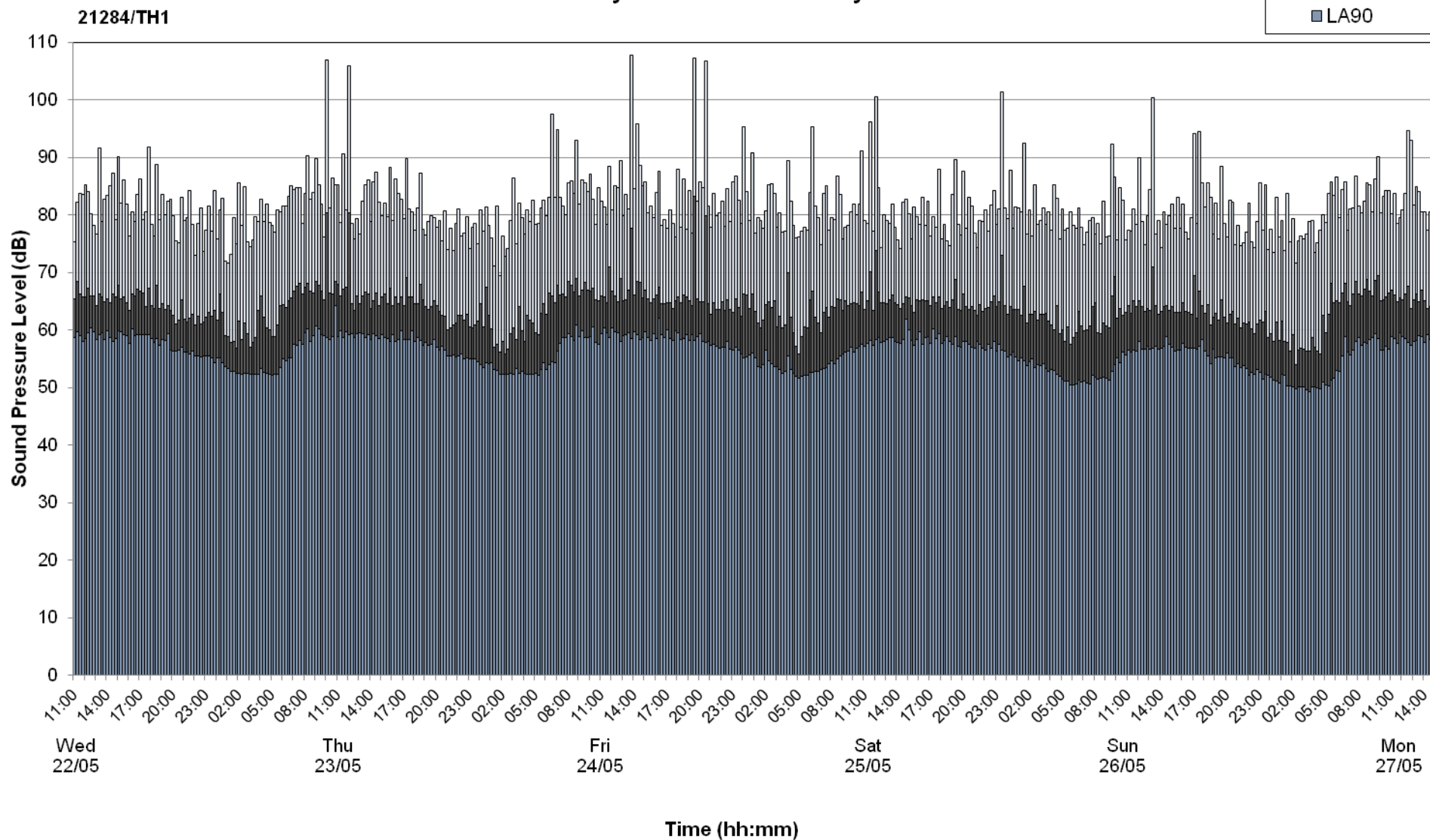
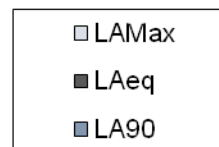
Equation :

$$Lp(int) = Lp(ext) + 10 \times \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{n,e}}{10}} + \frac{S_W}{S} 10^{\frac{-R_W}{10}} + \frac{S_g}{S} 10^{\frac{-R_g}{10}} + \frac{S_r}{S} 10^{\frac{-R_r}{10}} \right) + 10 \times \log_{10} \left(\frac{S}{A} \right) + 3$$

Charlotte House, Charlotte Street, Manchester

A-weighted Sound Levels at Automated Position 1

Wednesday 22/05/2015 - Monday 27/05/2015



Charlotte House, Charlotte Street, Manchester

A-weighted Sound Levels at Automated Position 2

Wednesday 22/05/2015 - Monday 27/05/2015

