

Amusement Arcade West Street Reading

Noise Impact Assessment Report

25200/NIA1

2 February 2018

For:
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Document Control

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1.0 Introduction

It is proposed to extend the operational hours of an existing amusement arcade on West Street in Reading, such that it runs for 24 hours 7 days a week.

Hann Tucker Associates have therefore been commissioned to undertake a detailed environmental noise survey of the site and a noise impact assessment of the proposed amusement arcade during the extended hours.

This report presents the survey methodology and findings of our assessment.

2.0 Objectives

To establish, by means of fully automated environmental noise monitoring, the existing A-weighted (dBA) L_{90} , L_{eq} and L_{max} environmental noise levels at the site.

To undertake a review of the relevant guidance and industry standards to establish appropriate assessment criteria and methodology for noise sources associated with the amusement arcade.

Based on the results of our environmental noise survey and the relevant guidance and industry standards, to assess the likely impact of operational noise generated by the proposed amusement arcade upon other uses in connected buildings and upon the surrounding buildings.

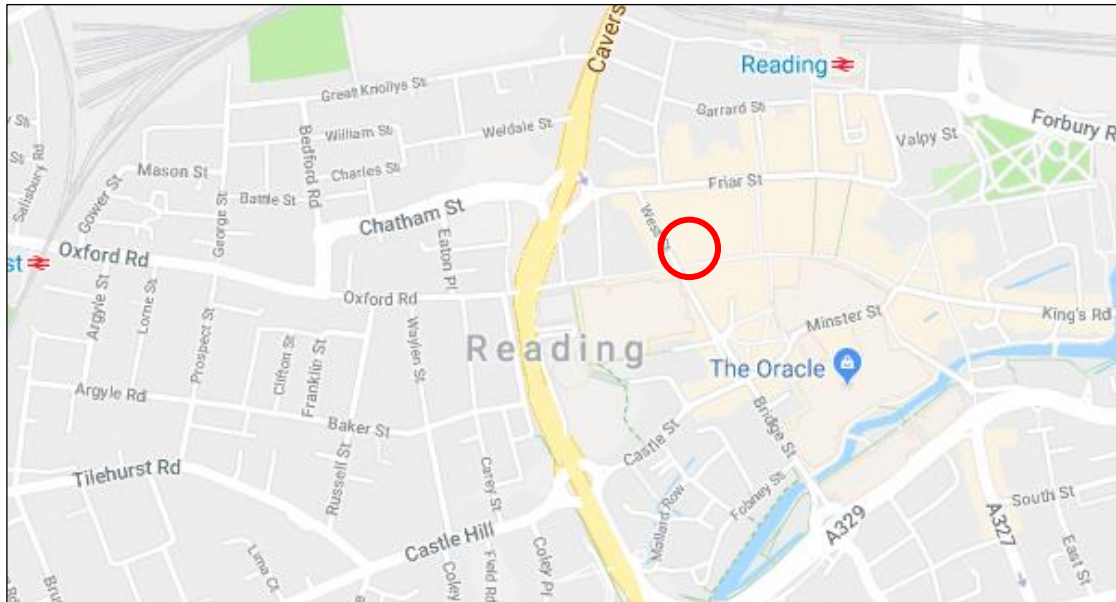
Where appropriate, to outline recommendations for mitigation measures to control noise generated by the amusement arcade.

Based on the results of our environmental noise survey and the requirements of the Local Authority, to recommend suitable plant noise emission limits.

3.0 Site Description

3.1 Location

The site is located at 9 West Street, Reading and falls within Reading Borough Council's jurisdiction. See location map below.



Location Map (maps.google.com)

3.2 Description

The site comprises of the arcade on the ground floor plus one storey. The surrounding buildings comprise predominantly ground floor commercial units with offices or residential uses on upper floors, and are generally comparable in height to 9 West Street. The current opening hours are between 9am and 10pm. It is understood that the ground floor unit directly adjacent to the site comprise a fast food outlet with residential on the first floor, which is believed to be the nearest residential to the arcade. See Site Plan below.



Site Plan (maps.google.com)



4.0 Acoustic Terminology

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

5.0 Planning Policy/Guidance

5.1 Noise Policy Statement for England

The Government's Noise Policy Statement for England (NPSE, 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.

The planning system should prevent both new and existing development from contributing to, or being put at, unacceptable risk from environmental factors including noise.

Planning policies and decisions should aim to avoid noise giving rise to significant adverse impacts on health and quality of life as a result of new development. Conditions may be used to mitigate and reduce noise to a minimum so that adverse impacts on health and quality of life are minimised.

Reference is made to the Government's Noise Policy Statement for England (NPSE, March 2010) which 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*".



5.3 Local Planning Requirements

We understand that Ross Jarvis of the Reading Environmental Health Team has corresponded with Caron Greene of Strydom Greene Planning with regards to considerations that should be taken in the noise assessment associated with the proposals.

In relation to suitable internal noise levels at effected noise sensitive premises, it is understood that the noise assessment should reference made to BS 8233:2014. Any noise egress and transfer that occurs due to the extended operating hours of the store should meet internal limiting levels as stated in BS8233:2014.

In relation to items of plant, the noise assessment for fixed plant should be based on BS 4142:2014 and the assessment must demonstrate that external plant does not exceed a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level.

5.4 BS 4142: 2014

BS 4142: 2014 *'Method for Rating industrial noise affecting mixed residential and industrial areas'* describes methods for rating and assessing the effects of outdoor sound levels, of an industrial and/or a commercial nature, *"on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident"*.

The impact of a specific sound is indicated by subtracting the existing background noise level from the rating level (i.e. noise level from the proposed items of plant/machinery/etc. plus any acoustic feature corrections).

The noise from the new development is expressed in terms of a rating level and given as a $L_{Aeq,T}$ noise level. The existing background noise level is expressed in terms of a $L_{A90,T}$ noise level. T is the assessment time interval, which is 1-hour for operations during daytime hours (07:00 to 23:00 hours) and 15-minutes for operations during night-time hours (23:00 to 07:00 hours).

A penalty should apply to plant emitting noise of a tonal, irregular or impulsive nature.

5.5 BS 8233: 2014

British Standard 8233: 2014 "Sound insulation and noise reduction for buildings" recommends design criteria for internal ambient noise levels for commercial units and residential dwellings providing a reasonable or good level of protection from external noise. It states that it is desirable that internal ambient noise levels do not exceed the following guidelines for residential dwellings:



Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 – 07:00
Resting	Living Rooms	35 dB $L_{Aeq,16\text{hour}}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16\text{hour}}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16\text{hour}}$	30 dB $L_{Aeq,8\text{hour}}$

For sites subject to scheduled impulsive events at night-time (such as train or aircraft passbys), BS 8233 would suggest peak noises during the night-time (23:00-07:00) should not regularly exceed 45 dB L_{Amax} in affected bedrooms.

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

For outdoor living spaces, a desirable upper guideline value of 55dB $L_{Aeq, T}$ is quoted.

The indoor ambient noise range quoted for restaurants is 40-55dB $L_{Aeq, T}$.

6.0 Baseline Noise Survey

6.1 Automated Survey

6.1.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 16:00 hours on Tuesday 30 January 2018 to 09:30 hours on Wednesday 31 January 2018 in order to establish the prevailing background noise levels at the site including a weekend. Measurements were taken continuously of the A-weighted (dBA) L_{90} , L_{eq} and L_{max} sound pressure levels over 15 minute periods.

During the periods we were on site the wind conditions were light and the sky was generally overcast. We understand that generally throughout the survey period the weather conditions were dry. These conditions are considered suitable for obtaining representative measurement results.

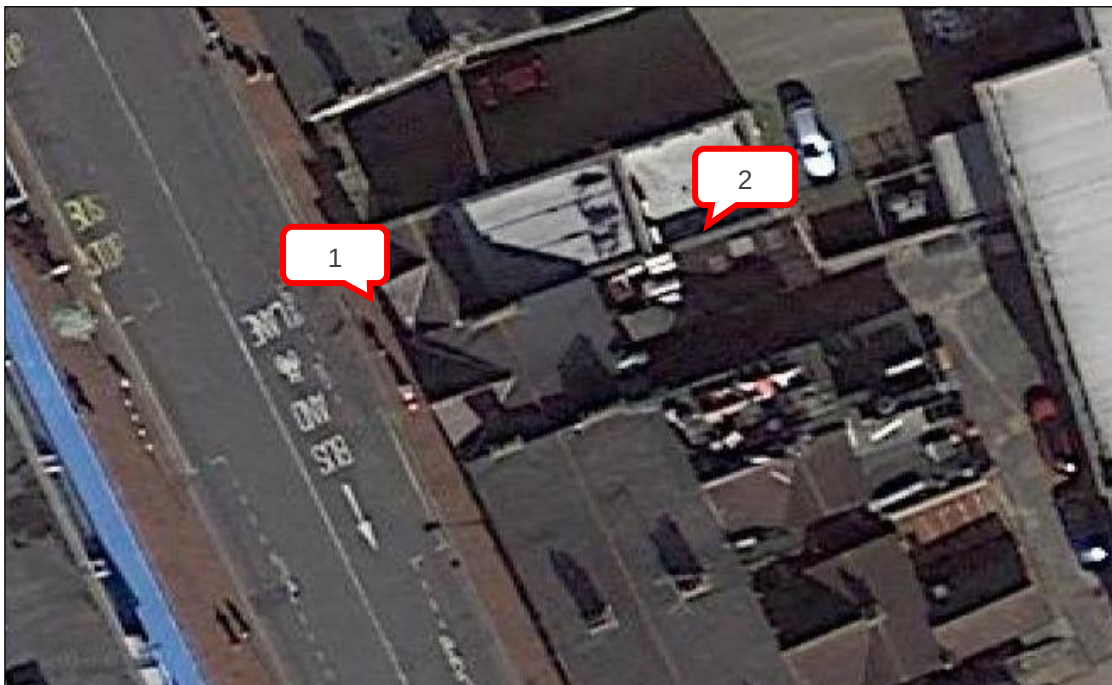
6.1.2 Measurement Positions

The noise level measurements were undertaken at 2No. positions as described in the table below.



Position No	Description
1	The microphone was attached to a pole at first floor level at a "façade" measurement position overlooking West Street.
2	The microphone was attached to a pole at roof level in free field conditions at the back of the property..

The positions are indicated on the plan below.



Plan Showing Measurement Positions (maps.google.com)

6.1.3 Instrumentation

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

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Data Logging Sound Level Meter	Larson Davis	824	3541	30/08/2017
Type 1 Data Logging Sound Level Meter	Larson Davies	824	3053	30/08/2017
Type 1 Calibrator	Larson Davis	CAL200	3083	13/04/2017

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 windshield.

All equipment was calibrated prior to and upon completion of the survey. No significant deviations were found to have occurred (no more than 0.1 dB).



6.2 Results

The results of the automated survey have been plotted on Time History Graphs 25200/TH1 and 25200/TH2 enclosed, presenting the 15 minute A-weighted (dBA) L_{90} , L_{eq} , and L_{max} noise levels recorded throughout the duration of the survey.

The following table summarises the daytime (07:00 – 23:00) and night-time (23:00 – 07:00) L_{Aeq} noise levels recorded. The results at position 1 have been corrected by -3dB to represent free field conditions.

Position	Period	Measured $L_{Aeq,T}$ Noise Levels (dB)
1	Daytime (07:00 – 23:00)	65
	Night-time (23:00 – 07:00)	60
2	Daytime (07:00 – 23:00)	56
	Night-time (23:00 – 07:00)	50

The lowest $L_{A90,15min}$ measurements recorded during the survey are presented in the table below:

Position	Period	Typical Lowest Background Sound Pressure Level, $L_{A90,15min}$ (dB)
1	Daytime (07:00-23:00)	49
	Night-time (23:00-07:00)	42
2	Daytime (07:00-23:00)	53
	Night-time (23:00-07:00)	43

7.0 Discussion of Noise Climate

During the periods we were on site the dominant noise source was noted to be traffic noise on West Street. It should also be noted that West Street is a busy City Centre road with numerous restaurants, cafés and heavy quantities of bus traffic which will generate noise.

8.0 Operational Noise Impact Assessments

8.1 Overview

Our assessment considers 24 hour operation of the existing amusement arcade, whereby current opening hours operate from 9am to 10pm.



Our assessment consider the following noise transfer paths:-

- Amusement arcade to food retail unit via walls;
- Amusement arcade noise breakout (via façade) to nearest residential;

Externally, the nearest noise sensitive receptor is the residential property above Roosters Piri Piri, approximately 3m from the external façade of the amusement arcade.

To inform our assessment of the unit operating as an amusement arcade, we have used historical data measured when attended an existing arcade site run by the applicant in order to obtain representative internal source noise levels. The measurements were made during a busy lunch-time period approximately 13:00 – 14:00 hours which we understand to be representative of peak occupancy.

The table below summarises the typical highest 5-minute noise level recorded:-

Location	Reverberant Noise Level (dB $L_{eq,5min}$) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
$L_{eq, 5min}$	58	65	73	71	69	62	54	51	73

N.B:- The above noise levels should be adopted as the limiting noise levels within the proposed amusement arcade.

8.2 Proposed Assessment Criteria

Internal Noise Transfer

Based on the above and the guidelines reviewed in Section 5.0, we would suggest internal noise transfer to the adjacent food retail unit is controlled to the lower limit of the design target levels, 40dB $L_{Aeq,T}$.

External Noise Breakout

In relation to noise egress to the external residential receptor, operational noise shall achieve 38dB $L_{Aeq,T}$ at 1 metre from the residential window, which is 5 dB below prevailing background noise levels.

It is generally accepted that the typical noise reduction achieved with partially opened windows is around 15dBA (ref. BS 8233:2014 Annex G.1). Therefore in order to achieve BS 8233:2014 internal noise limits in the most sensitive rooms, i.e. bedrooms, operational noise shall achieve



50dB $L_{Aeq,T}$ in the daytime and 45dB $L_{Aeq,T}$ at night-time.

Limits set in relation to background in accordance with BS 4142:2014 are lower than targets set when considering BS 8233:2014. It is therefore seen as an appropriately rigorous approach to design to 5dB below background.

8.3 Assessment of Internal Noise Transfer

Through Separating Walls to Retail Unit/Café

The details of the construction of the party wall between the proposed amusement arcade and the food retail is not known, however based on our observations on site, we would expect the separating wall to comprise at least 2No. layers of brick with plasterboard on one side, as observed within the arcade. On this basis, the walls can be expected to provide the following conservative sound reduction performance.

Minimum Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
34	41	44	48	55	60	60	65

Based on the above, and the amusement arcade measured reverberant source noise levels (Section 8.1), we have assessed operational noise transfer to the food retail unit using in-house calculation software. The results are summarised below and compared against the proposed assessment criteria (Section 8.2)

Our assessment is based on the following equation where SRI is the composite sound reduction of the façade, r is the distance and S the radiating area.

$$SPL_{out} = SPL_{in} - SRI + 10\log_{10}\left(\frac{S}{r^2}\right) - 14$$

Description	dBA
SPL	73
Composite SRI	-49
$10\log_{10}(S/r^2)$	+17
-14	-14
SPL at receptor, $L_{eq,15min}$	27
Proposed Limits	40
Compliance Note	✓



The above indicates the operation of the unit as an amusement arcade should comfortably satisfy our proposed noise limits within the adjacent food retail unit and thus no adverse noise impact would be expected.

8.4 Assessment of External Noise Breakout

The frontage of the commercial unit comprises large elements of glazing (estimated to be single glazing, circa 8mm thick) with two poorly sealed entrance doors. The sound reduction performance figures for these elements used in our calculations are presented below.

Element	Estimated Sound Reduction, R (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Windows	18	20	24	28	32	32	34	35
Single doors	16	18	21	25	28	32	32	32

Based on the above, the latest drawings for the scheme and reverberant source noise levels (Section 8.1), we have assessed the 24hr operational noise output to the nearest residential window. The results are summarised below and compared against the proposed assessment criteria (Section 8.2).

Our assessment is based on the following equation where SRI is the composite sound reduction of the facade, r is distance and S is the radiating area.

$$SPL_{out} = SPL_{in} - SRI + 10 \log_{10} \left(\frac{S}{r^2} \right) - 14$$

Description	dBA
SPL	73
Composite SRI	-29
$10 \log_{10}(S/r^2)$	-1
-14	-14
SPL at receptor, $L_{eq,15min}$	29
Proposed Limits	38
Compliance Note	✓

The above indicates the operation of the unit as an amusement arcade should comfortably satisfy the proposed noise breakout limits, thus indicating no adverse noise impact on the nearest residential.

It should be noted that all our assessments have been based on worst case noise levels during busy lunch hours. For most hours of operation noise levels are likely to be lower than this and therefore the risk of adverse noise impact is further reduced.



9.0 Plant Noise Emission Limits

9.1 Proposed Limits

On the basis of the requirements of the Local Authority as outlined in Section 5.3 and the results of the environmental noise survey, we propose that any plant running during the extended operating hours the following plant noise emission limits at the nearest noise sensitive location with all plant operating simultaneously. This is 5 dB below the measured background noise level.

Period	BS 4142 Plant Noise Rating Limit (dB)
Daytime (07:00-23:00hr)	47
Night-time (23:00-07:00hr)	38

Plant noise shall be assessed in accordance with BS 4142: 2014.

10.0 Conclusions

The existing A-weighted (dBA) L_{90} , L_{eq} and L_{max} environmental noise levels at the site have been established by means of fully automated noise monitoring.

A review of the relevant guidance and industry standards has been undertaken to establish appropriate assessment criteria and methodology for various new noise sources associated with the scheme.

The likely impact of noise generated by the extended opening hours of the amusement arcade at ground floor level upon structurally connected uses and upon the surrounding buildings has been assessed. The assessment indicates that no adverse noise impact is likely to arise from the scheme, and as such no mitigation measures beyond adhering to the worst-case source noise levels outlined herein (Section 8.1) are required.

Plant noise emission limits for items of external plant have been set.



Appendix A

The acoustic terms used in this report are defined as follows:

dB Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The _A subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that 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.

L_{90,T} L₉₀ is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

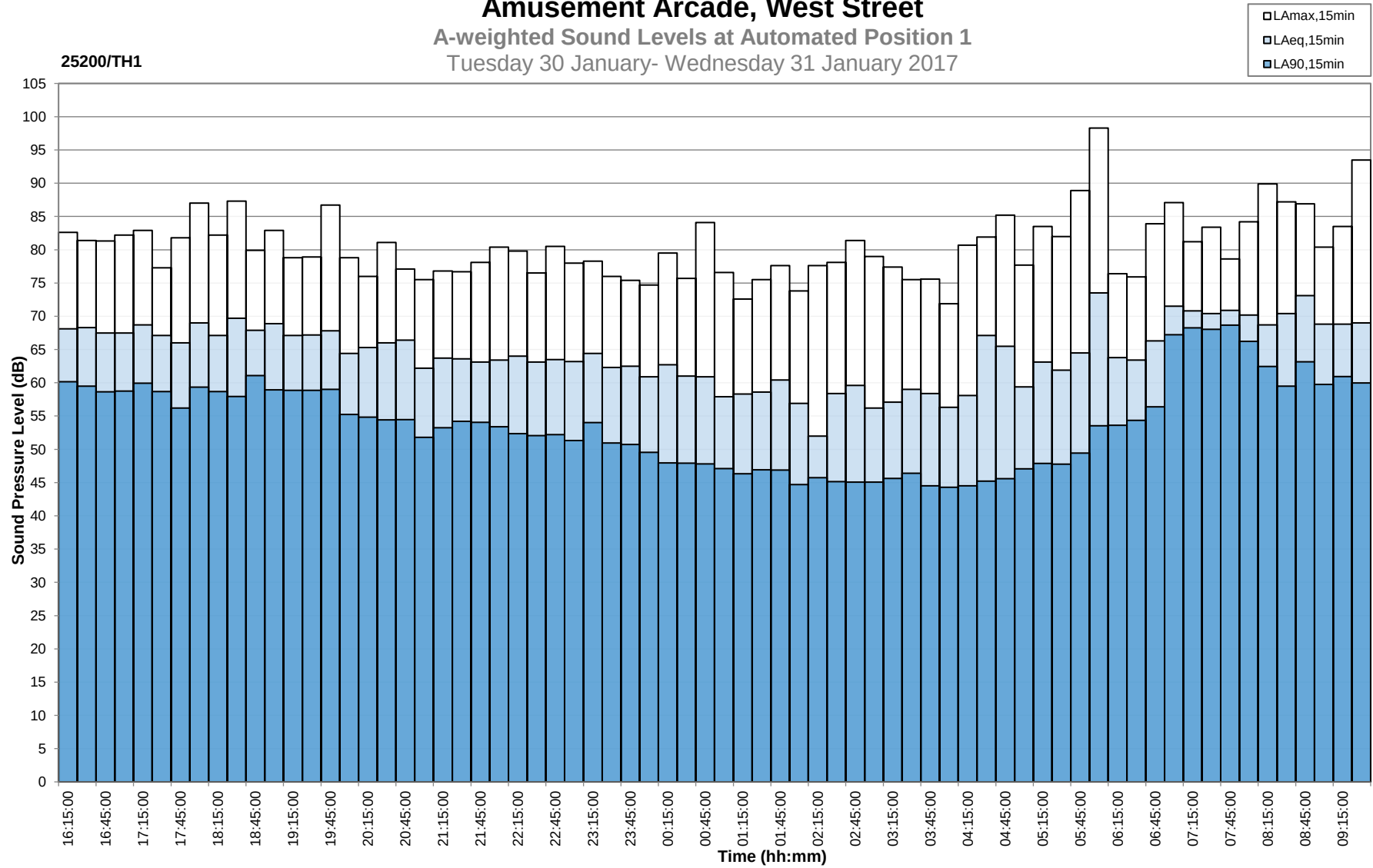
L_{eq,T} L_{eq,T} is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

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.

L_p Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

L_w Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Amusement Arcade, West Street
A-weighted Sound Levels at Automated Position 1
Tuesday 30 January- Wednesday 31 January 2017



Amusement Arcade, West Street
A-weighted Sound Levels at Automated Position 2
Tuesday 30 January- Wednesday 31 January 2017

