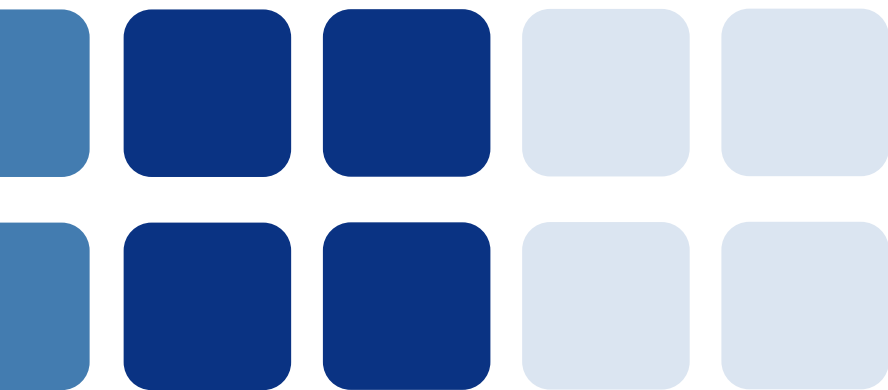




BRISTOL & WEST  
ARCADE  
READING

## ACOUSTIC ASSESSMENT REPORT

REPORT 8358/AAR  
Prepared: 13 February 2018  
Revision Number: 0

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# Acoustic Assessment Report



BRISTOL & WEST ARCADE  
READING

REPORT 8358/AAR

Prepared: 13 February 2018

| Revision | Comment                                                             | Date             | Prepared By | Approved By        |
|----------|---------------------------------------------------------------------|------------------|-------------|--------------------|
| 0        | First Issue                                                         | 2 February 2018  | Toby Walton | Russell Richardson |
| 1        | Advice regarding secondary glazing requirements in listed buildings | 13 February 2018 | Josh Evans  | Russell Richardson |
|          |                                                                     |                  |             |                    |

## Terms of contract:

RBA Acoustics Ltd has prepared this report in accordance with our Acoustic Consultancy Brief 8358/ACB dated 8 January 2018. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

In line with our Environmental Policy, one hard copy of the report will be provided, upon request. Additional copies of the report, or further hard copies of revised reports, would be subject to an administrative cost of £20.00 (+VAT) per copy.



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## 1.0 INTRODUCTION

The re-development of empty retail space at the former Bristol & West Arcade, and 27 – 32 Market Place is proposed. The development will consist of offices, retail units, a Public House and residential flats.

The site is located in central Reading with Friar Street to the North-West of the Bristol & West Arcade, and Market Place running Southbound adjacent to 27 – 32 Market Place. Adjacent buildings to the site are retail units.

An assessment has been carried out in relation to the noise levels likely to be incident on the proposed building façades and to provide acoustic performance specifications such that acceptable internal noise criteria can be achieved.

This report details the results of the noise survey and sets out the acoustic performance requirements of the external building fabric elements. In addition, suitable plant noise emission criteria have also been developed based upon the survey results and the likely requirements of the Local Authority.

Analyses have been undertaken of the noise impact on the nearest residential properties of deliveries to the development site and the results are presented herein.

This report is based upon application drawings and details and is suitable for submission with the planning application.

## 2.0 ENVIRONMENTAL NOISE SURVEY

### 2.1 Survey Methodology

#### *General*

Continuous noise monitoring was undertaken at the proposed site between the following times in order to determine the corresponding noise levels over typical day and night-time periods:

14:00 hours Thursday 25 January to 11:00 hours Tuesday 30 January 2018

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period, however the weather was generally considered appropriate for obtaining valid noise data, it being predominantly dry with little wind.

Measurements were made of the  $L_{A90}$ ,  $L_{Amax}$  and  $L_{Aeq}$  noise levels over sample periods of 15 minutes duration.

### Instrumentation

The following instrumentation was used for the survey:

Table 8358/T1 – Equipment Details

| Manufacturer                      | Model Type | Serial No. | Calibration     |                   |
|-----------------------------------|------------|------------|-----------------|-------------------|
|                                   |            |            | Certificate No. | Expiry Date       |
| Norsonic Type 1 Sound Level Meter | Nor140     | 1406971    | 4715702365      | 11 September 2019 |
| Norsonic Pre Amplifier            | 1209       | 21206      |                 |                   |
| Norsonic ½" Microphone            | 1225       | 271059     | 4715702365      | 11 September 2019 |
| Norsonic Sound Calibrator         | 1251       | 35016      | U26573          | 11 September 2019 |
| Norsonic Type 1 Sound Level Meter | Nor140     | 1406970    | 4715701644      | 11 September 2019 |
| Norsonic Pre Amplifier            | 1209       | 21205      |                 |                   |
| Norsonic ½" Microphone            | 1225       | 271055     | 4715701644      | 11 September 2019 |
| Norsonic Sound Calibrator         | 1251       | 35020      | U26579          | 12 September 2019 |
| Norsonic Type 1 Sound Level Meter | Nor140     | 1406255    | 24932           | 6 March 2019      |
| Norsonic Pre Amplifier            | 1209       | 20491      |                 |                   |
| Norsonic ½" Microphone            | 1225       | 225529     | 24931           | 6 March 2019      |
| Norsonic Sound Calibrator         | 1251       | 34391      | U24930          | 6 March 2019      |

The sound level meters were calibrated both prior to and on completion of the survey with no calibration drifts observed.

### Measurement Positions

#### Position 1 – Bristol & West Façade

A microphone was positioned 1m from the Northern façade of the former Bristol & West Arcade at third floor level, overlooking the pedestrianised Town Hall Square. The results of the measurements at this position are considered to be subject to façade reflection effects.

#### Position 2 – Market Place Façade

A microphone was positioned 1m on the Eastern façade of 27 – 32 Market Place at first floor level, overlooking Market Place. The results of the measurements at this position are considered to be subject to façade reflection effects.

#### Position 3 – Overlooking Rear Podium Roof

A microphone was positioned on a tripod at roof level overlooking the podium roof to the rear of the Bristol & West Arcade. The results of the measurements at this position were obtained in free-field conditions.

The measurement positions are also shown on the attached Site Plan 8358/SP1 and Photographs 8358/P1-P3.

The measurement positions are considered to be representative of worst-case noise levels incident on the proposed aspects of the re-development.

## 2.2 Site Conditions

Since the measurements were unattended it is not possible to comment upon the noise climate at each measurement position over the entire monitoring period with absolute certainty. However, during our time on site it was noted that noise levels at Measurement Position 1 were dominated by road traffic movements along Blagrove St, pedestrian and conversational noise within the Town Hall Square area, and early morning activities such as street cleaning and rubbish collection. Blagrove St was noted to be busy, it being a main bus route, and a road providing access to retail units for deliveries. The traffic was noted to consist of various types of road vehicle, however it was dominated by buses and taxis providing access to the town centre and nearby restaurants and bars. A bus stop is situated around 28m from the façade of the proposed development, and it was noted that buses would often idle there for long periods. The buses are likely to provide the maximum noise levels to the general noise climate to the north of the site.

At Measurement Position 2 it was noted that noise levels were affected predominantly by road traffic movements along Market Place. Again, the traffic was noted to consist of various types of road vehicle, however it was dominated by buses and taxis providing access to the town centre, nearby restaurants and bars. It was noted that the bus stops directly opposite the façade of the proposed development mostly accommodated double-decker buses and coaches providing access to destinations further afield. A total number of four bus stops are within 50m of this position. The buses are likely to provide the maximum noise levels to the general noise climate to the north of the site.

At Measurement Position 3, it was noted that noise levels were generally low, it being generally screened from local traffic. Pedestrian movements were considered to be the main source of noise.

Measurement Position 4 was generally quiet, the main source of noise being rooftop plant associated with the adjacent Marks & Spencer's retail unit. The position was screened from local traffic.

## 2.3 Results

The measured  $L_{Aeq}$ ,  $L_{A90}$  and  $L_{Amax}$  15 minute period levels are shown as time-histories on the attached Graphs 8358/G1-6. The averaged daytime and night-time  $L_{Aeq}$  noise levels are summarised in Table 8358/T2 below.

Table 8358/T2 – Measured  $L_{Aeq}$  Noise Levels

| Measurement Position | Average Façade Corrected $L_{Aeq, period}$ Noise Level (dB) |                            |
|----------------------|-------------------------------------------------------------|----------------------------|
|                      | Thursday 25 January – Tuesday 30 January 2018               |                            |
|                      | Daytime (07:00 – 23:00)                                     | Night-time (23:00 – 07:00) |
| Position 1           | 58                                                          | 59                         |
| Position 2           | 61                                                          | 59                         |
| Position 3           | 54                                                          | 52                         |

The minimum background noise levels ( $L_{A90, 15\text{mins}}$ ) at each measurement position are summarised in Table 8358/T3 below. This data can be used to set plant noise emission criteria for use in the assessment of noise emissions from any proposed plant at the development.

Table 8358/T3 – Measured Minimum  $L_{A90, 15\text{mins}}$  Noise Levels

| Measurement Position | Minimum $L_{A90, 15\text{mins}}$ Noise Level during period (dB) |                            |
|----------------------|-----------------------------------------------------------------|----------------------------|
|                      | Thursday 25 January – Tuesday 30 January 2018                   |                            |
|                      | Daytime (07:00 – 23:00)                                         | Night-time (23:00 – 07:00) |
| Position 1           | 46                                                              | 44                         |
| Position 2           | 45                                                              | 42                         |
| Position 3           | 47                                                              | 48                         |

Averaged spectral noise levels are graphically represented on the attached Graphs 8358/G7-G9.

### 3.0 PLANT NOISE EMISSION CRITERIA

The requirements of the Local Authority with regards to plant noise emissions are not currently known. However, given the prevailing noise climate we propose a noise level limit of 10 dB below the background ( $L_{A90}$ ) for all operating plant at 1m from the nearest noise-sensitive façade. In line with this we would propose items of mechanical services are designed such that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise-sensitive location:

Table 8358/T4 – Plant Noise Emission Limits

| Measurement Position | $L_{Aeq}$ Noise Level limit of all operating plant (dB) at 1m from the nearest noise sensitive façade |                            |
|----------------------|-------------------------------------------------------------------------------------------------------|----------------------------|
|                      | Daytime (07:00 – 23:00)                                                                               | Night-time (23:00 – 07:00) |
| Position 1           | 36                                                                                                    | 34                         |
| Position 2           | 35                                                                                                    | 32                         |
| Position 3           | 37                                                                                                    | 38                         |

In line with BS 4142, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be applied to any of the above proposed noise emission limits in Table 8358/T4.

## 4.0 PLANNING CRITERIA

This section outlines the assessment criteria we anticipate the Local Authority will require in terms of the relevant standards. A brief explanation of the acoustic terminology used in this report is shown within Appendix A.

### 4.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF), March 2012, sets out the Government's planning policies for England. In respect of noise, Paragraph 123 of the NPPF states the following:

Planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

The above presents no quantitative guidance on a site's suitability for residential development and we have therefore, for the purposes of this assessment, made reference to the following documents.

### 4.2 ProPG

ProPG: Planning & Noise provides guidance on a recommended approach to the management of noise within the planning system in England and was published by the Association of Noise Consultants, the Institute of Acoustics and the Chartered Institute of Environmental Health in May 2017.

It encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. In light of the recent publication of ProPG, it was considered appropriate to make use of this document for this report, containing the results of our noise survey and provides advice for the pre-planning stage of development conditions.

ProPG provides the following Noise Risk Assessment scale:

Table 8358/T5 – ProPG Noise Risk Assessment

| Noise Risk | Indicative $L_{Aeq, period}$ Noise Levels (dB) |                                               | Comments                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------|------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Daytime $L_{Aeq, 16 hr}$<br>(07:00 – 23:00)    | Night-time $L_{Aeq, 8 hr}$<br>(23:00 – 07:00) |                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Negligible | <50 dB                                         | <40 dB                                        | These noise levels indicate that the development site is likely to be acceptable, and the application need not normally be delayed on noise grounds.                                                                                                                                                                                                                                                                        |
| Low        | 50 dB < L < 60 dB                              | 40 dB < L < 50 dB                             | At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.                                                                                                                                       |
| Medium     | 60 dB < L < 70 dB                              | 50 dB < L < 60 dB                             | As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development. |
| High       | >70 dB                                         | >60 dB                                        | High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.                                                                                                                                            |

## 5.0 EXTERNAL BUILDING FABRIC CRITERIA

This section outlines the assessment criteria we anticipate the Local Authority will require in terms of the relevant standards. A brief explanation of the acoustic terminology used in this report is shown within Appendix A.

### Residential Criteria

#### 5.1 British Standard 8233:2014

BS 8233:2014 *Guidance on Sound insulation and noise reduction for buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions.

The noise level values given are in terms of an average ( $L_{Aeq}$ ) level.

The standard advises the following internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties. A brief explanation of the acoustic terminology used in this report is shown in Appendix A attached.

Table 8358/T7 – BS 8233:2014 Residential Criteria

| Room             | Daytime (07:00 to 23:00) | Night-time (23:00 to 07:00) |
|------------------|--------------------------|-----------------------------|
| Living Rooms     | 35 dB $L_{Aeq,16hour}$   | --                          |
| Dining Room/area | 40 dB $L_{Aeq,16hour}$   | --                          |
| Bedrooms         | 35dB $L_{Aeq,16hour}$    | 30 dB $L_{Aeq,8hour}$       |

#### 5.2 World Health Organisation: Guidelines for Community Noise

The document describes guideline levels that are “*essentially values for the onset of health effects from noise exposure*”.

A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure.

The following is an extract from *Table 4.1: Guideline values for community noise in specific environments*, as stated in the document.

Table 8358/T8 – Guideline Values for Community Noise

| Specific Environment | Critical Health Effect(s)                                          | $L_{Aeq}$ (dB) | Time Base (hours) | $L_{Amax,f}$ (dB) |
|----------------------|--------------------------------------------------------------------|----------------|-------------------|-------------------|
| Outdoor living area  | Serious annoyance, daytime and evening                             | 55             | 16                | -                 |
|                      | Moderate annoyance, daytime and evening                            | 50             | 16                | -                 |
| Dwelling, indoors    | Speech intelligibility and moderate annoyance, daytime and evening | 35             | 16                | -                 |
| Inside bedrooms      | Sleep disturbance, night-times                                     | 30             | 8                 | 45                |
| Outside bedrooms     | Sleep disturbance, window open (outdoor values)                    | 45             | 8                 | 60                |

With reference to maximum noise levels the following guidance is provided within the WHO guidance:

*“For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB  $L_{Amax}$  more than 10-15 times per night (Vallet & Vernet 1991) and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10-30s, SEL values of 55-60 corresponds to a  $L_{Amax}$  value of 45dB. Ten to 15 of these events during an 8 hour night-time implies a  $L_{Aeq, 8h}$  of 20-25dB. This is 10-15dB below the  $L_{Aeq, 8h}$  or 30dB for continuous night-time noise exposure, and shows that intermittent character of noise must be taken into account when setting night-time noise limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background of these events.”*

Therefore the frequency of occurrence of maximum noise events should not typically exceed 10-15 times in any night.

## Commercial and Office Area Criteria

### 5.3 British Standard 8233:2014

There are no specific requirements within commercial areas of the development. Ultimately the design criterion for commercial spaces will depend on the end user activity. Hence, we outline criteria for these areas based on the guidance within BS 8233:2014. The standard advises the following internal ambient noise levels ( $L_{Aeq}$ ) for the given activity and conditions for work requiring concentration within offices.

Table 8358/T9 – BS 8233:2014 Non-Residential Criteria

| Activity                               | Location                          | Design Range $L_{Aeq,T}$ (dB) |
|----------------------------------------|-----------------------------------|-------------------------------|
| Speech or Telephone Communications     | Department Store                  | 50-55                         |
|                                        | Corridor, Circulation Space       | 45-55                         |
| Study and Work Requiring Concentration | Staff/Meeting Room, Training Room | 35-45                         |
|                                        | Executive Office                  | 35-40                         |

The standard also advises that noise levels should be within the range of 45-50 dBA within open plan offices where acoustic privacy is important.

## 5.4 Summary

### Residential Areas

The project criteria adopted are therefore as follows;

|              |                          |                                       |
|--------------|--------------------------|---------------------------------------|
| Bedroom      | Night-time (23:00-07:00) | 30 dB $L_{Aeq}$<br>45 dB $L_{Amax,f}$ |
| Living Rooms | Daytime (07:00-23:00)    | 35 dB $L_{Aeq}$                       |

### Non-Residential Areas

The project criteria adopted are therefore as follows;

|               |                               |                    |
|---------------|-------------------------------|--------------------|
| Office Spaces | Daytime (07:00 – 23:00 hours) | 45-50 dB $L_{Aeq}$ |
|---------------|-------------------------------|--------------------|

## 6.0 TRAFFIC NOISE IMPACT ASSESSMENT CRITERIA

### 6.1 Local Authority Requirements

We are not aware of any specific requirements for the assessment of traffic noise impact which are required by Reading Borough Council.

### 6.2 IEMA: Guidelines for Environmental Noise Impact Assessment

'Guidelines for Environmental Noise Impact Assessment', produced by the Institute of Environmental Management and Assessment (IEMA), addresses the key principles of noise impact assessment and provides guidance on how noise impact assessment should be approached.

This document recognises that each situation encountered is likely to be different and that there is no single set of subjective assessment criteria that would apply to all situations. When assessing the subjective impact of any development it is important to consider the specific circumstances of the site. In many cases, a simple comparison of changes in noise levels is sufficient to establish the noise impact; in others, other factors or features of the change might need to be taken into account to determine the extent of any effect and its significance.

In the case of the residences around the Bristol & West Arcade development site our measurements and observations have shown existing noise levels are generally dominated by pedestrian and conversational noise within the Town Hall Square area and road traffic movements on the adjacent Blagrove St. The primary route to and from the development site is also predicted to be via Blagrove St, and the additional traffic flows can therefore be assumed to be similar in type, speed and characteristics to existing traffic movements. We therefore propose a comparison of average noise levels before (by measurement) and after (by calculation) the completion of the development is appropriate in this case.

In assessing the impact of specific noise sources such as those anticipated at this development it is usual to compare the average noise level ( $L_{Aeq}$ ) of the noise source with the existing measured  $L_{Aeq}$  noise level.

The categorisation shown in Table 8358/T10 therefore takes this as its basis, with changes made as appropriate to reflect the proposed development's own circumstances, as defined in the guidelines.

Table 8358/T10 – Impact of Changes in Noise Level

| Noise Change (dB) | Category           |
|-------------------|--------------------|
| 0.0               | No Impact          |
| 0.1-1.9           | Negligible Impact  |
| 2.0-3.9           | Slight Impact      |
| 4.0-6.9           | Significant Impact |
| 7.0-9.9           | Substantial Impact |
| 10.0 and above    | Severe Impact      |

IEMA also provides guidance on the relationship between noise impact and noise effect that can help in evaluating the significance of any effect.

Table 8358/T11 – Relationship Between Noise Impact and Noise Effect

| Magnitude (Nature of Impact) | Description of Effect (Receptor Perception) |
|------------------------------|---------------------------------------------|
| Substantial                  | Marked change                               |
| Moderate                     | Noticeable improvement                      |
| Slight                       | Just noticeable improvement                 |
| Negligible                   | No discernible effect                       |
| Slight                       | Non-intrusive                               |
| Moderate                     | Intrusive                                   |
| Substantial                  | Disruptive                                  |
| Severe                       | Physically harmful                          |

In addition to the comparison of  $L_{Aeq}$  noise levels before and after the proposed development, it is important to understand the potential subjective effect of such changes in the noise level.

Table 8358/T12 compares the subjective response of typical subjects to variations in sound pressure level. Please note, the change in loudness and how noticeable this may be is only applicable where the character of the existing and predicted noise is the same. As this assessment is investigating the effect of adding more traffic (of a similar type) to an existing road, this is valid in this case.

Table 8358/T12 – Subjective Response

| Changes in Sound Level (dB) | Change in Power |          | Change in Apparent Loudness |
|-----------------------------|-----------------|----------|-----------------------------|
|                             | Decrease        | Increase |                             |
| 3                           | $\frac{1}{2}$   | 2        | Just Perceptible            |
| 5                           | $\frac{1}{3}$   | 3        | Clearly Noticeable          |
| 10                          | $\frac{1}{10}$  | 10       | Half or Twice as Loud       |
| 20                          | $\frac{1}{100}$ | 100      | Much Quieter or Louder      |

## 7.0 EXTERNAL BUILDING FABRIC ASSESSMENT

### 7.1 Background

Appropriate internal noise levels can be achieved providing suitable building envelope constructions are employed.

Analyses of the external building fabric have been undertaken in order to ascertain the required acoustic performance of the glazing and other external fabric elements to achieve the project criteria.

### 7.2 Preliminary Assessment

Our initial assessment of achievable internal noise levels has been based upon the following information

- Environmental noise survey data reported herein
- External wall construction is brick or blockwork
- Glazing makes up 50% of the external façade
- Whole house MVHR will be adopted (i.e. no trickle ventilators)
- Living Rooms will typically contain hard floor surfaces, curtains and soft furnishings and bedrooms will be carpeted

#### *Brickwork Wall Areas*

External wall construction – external brickwork skin, thermal insulation, Metsec stud with mineral wool between studs, 2 layers of 12.5mm standard plasterboard.

Table 8358/T13 – Assumed Sound Reduction Performance of External Wall Construction

| Assumed Sound Reduction Index [dB] at Octave Band Centre Frequency [Hz] |     |     |     |    |    |    |    |
|-------------------------------------------------------------------------|-----|-----|-----|----|----|----|----|
| 63                                                                      | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| 35                                                                      | 42  | 48  | 53  | 63 | 70 | 74 | 74 |

#### *Friar Street/Blagrove Street Façade*

Acceptable internal noise levels for residential use should be achieved with acoustically rated double-glazed units.

The following example double-glazing configurations are given as examples of the type of glazing would typically be acoustically appropriate.

- Bedrooms - 10mm glass / 12 mm airspace / 8.4 mm glass configuration ( $R_w$  42 dB), or similar.
- Living Rooms - 4mm glass / 12mm cavity / 6mm glass ( $R_w$  32 dB), or similar.

#### *Market Place Facade*

Acceptable internal noise levels for residential use should be achieved with acoustically rated secondary glazing. As units 27-32 Market Place are listed buildings all modifications to the windows should be deferred to the Conservation Officer of Reading Borough Council.

The following example double-glazing configurations are given as examples of the type of glazing would typically be acoustically appropriate.

- Bedrooms – Secondary glazing configuration with a minimum 100 mm airspace or similar.

- Living Rooms – Secondary glazing configuration with a minimum 100 mm airspace configuration or similar.

#### *Public Access Route*

Acceptable internal noise levels for residential use should be achieved with acoustically rated double-glazed units.

The following example double-glazing configurations are given as examples of the type of glazing would typically be acoustically appropriate.

- Bedrooms – 4mm glass / 12mm airspace / 6mm glass configuration ( $R_w$  32 dB) or similar.
- Living rooms – 4mm glass / 12mm airspace / 6mm glass configuration ( $R_w$  32 dB) or similar.

#### *Offices*

Internal noise levels within the proposed offices appropriate to the project criteria will be able to be controlled with standard thermal double glazing with differing pane thicknesses, e.g. 4mm glass / 12mm cavity / 6mm glass ( $R_w$  32 dB), or similar.

## 8.0 INTERNAL BUILDING FABRIC CRITERIA

It is important for the internal building fabric to incorporate sufficient protection, such that occupants of different areas of the building do not cause disturbance to one another, especially where there are residential units adjacent to public amenity areas.

This report provides preliminary guidance regarding the likelihood of the proposed constructions offering sufficient levels of sound insulation appropriate to their proposed uses.

In this report we have assessed proposed constructions for internal building fabric elements separating areas with differing uses (planning Class) and provide guidance on suitable upgrades, where required, to achieve suitable levels of sound insulation throughout the development.

## 9.0 INTERNAL BUILDING FABRIC CRITERIA

A summary of the various requirements of the development in terms of Approved Document E (2003) of the Building Regulations are included as follows.

### 9.1 Approved Document E (2003)

Building Regulations Approved Document E (2003) provides guidance for levels of sound insulation within residential developments formed from a material change of use. These criteria are applicable to separating walls and floors between individual demises and also between demises and common parts but does not apply to walls containing doors or to walls separating bedrooms from their associated en-suite bathrooms. Therefore the sound insulation criteria to be achieved are as follows:

#### *Separating Floors*

Minimum airborne sound insulation of 45dB  $D_{nT,w} + C_{tr}$ . This is an on-site performance rating.

Maximum impact sound pressure level of 62dB  $L'_{nT,w}$ . This is an on-site performance rating.

#### *Separating Walls*

Minimum airborne sound insulation of 45dB  $D_{nT,w} + C_{tr}$ . This is an on-site performance rating.

### Retail to Offices (Ground to First Floor)

There are no specific minimum sound insulation requirements between retail and office units, although it is typical for an enhanced sound insulation performance criterion to be specified in such situations. This would typically be of the order of a 5 dB improvement over the normal Building Regulations requirements detailed in 10.1.

We understand the planning use class for the commercial unit could be A1 (shops), A2 (professional/financial services), A3 (restaurants and cafes), A4 (drinking establishments) or B1(a) (offices).

We therefore propose a criterion of 5 dB above the normal Building Regulations requirement is appropriate in this case.

## 9.2 Offices to Residential (Third to Fourth Floor)

There are no specific minimum sound insulation requirements between commercial and residential units, although it is typical for an enhanced sound insulation performance criterion to be specified in such situations. This would typically be a 5-10 dB improvement over the normal Building Regulations requirements detailed in 10.1.

We therefore propose a criterion of 10 dB above the normal Building Regulations requirement is appropriate in this case.

# 10.0 PROPOSED FLOOR CONSTRUCTIONS

## 10.1 Separating Floors Between Apartments

We understand that the main separating floor construction between apartments is to comprise an overall depth of 500mm. The following preliminary construction is proposed:

### Separating Floors between Apartments

- 15mm floor finish
- 50mm screed
- 50mm thermal insulation
- 10mm resilient layer
- 200mm RC concrete

Subject to the above and ensuring a high level of build quality and appropriate detailing of the flanking transmission paths we consider the proposed floor construction to be commensurate with achieving the performance standards for airborne and impact sound insulation outlined in Section 10.

## 10.2 Separating Floors Between Apartments and Offices

We understand that the main separating floor construction between apartments and offices is to comprise an overall depth of 915mm. The following preliminary construction is proposed:

### Separating Floors between Apartments and Offices

- 15mm floor finish
- 50mm screed
- 50mm thermal insulation
- 10mm acoustic resilient layer
- 200mm RC concrete
- Suspended ceiling tiles

Subject to the above and ensuring a high level of build quality and appropriate detailing of the flanking transmission paths we consider the proposed floor construction to be commensurate with achieving the performance standards for airborne and impact sound insulation outlined in Section 10.

### 10.3 Separating Floors Between Offices and Retail

We understand that the main separating floor construction between offices and retail is to comprise an overall depth of 1500mm. The following preliminary construction is proposed:

#### Separating Floors between Apartments

- Floor finish (hard flooring or carpet)
- Raised access floor on pedestals
- 200mm RC concrete
- Ceiling in retail unit as required

Subject to the above and ensuring a high level of build quality and appropriate detailing of the flanking transmission paths we consider the proposed floor construction to be commensurate with achieving the performance standards for airborne and impact sound insulation outlined in Section 10.

## 11.0 TRAFFIC NOISE IMPACT ASSESSMENT

### 11.1 Introduction to Assessment Procedure

This assessment investigates the noise impact of noise from delivery/collection vehicles serving the new development. The assessment has been based on predicted traffic flows provided by Motion.

### 11.2 Summary of Existing Noise Levels

Reference to Measurement Position One in Table 8358/T2 indicates average ( $L_{eq}$ ) façade-corrected noise levels at the nearest affected property, the 4<sup>th</sup> floor windows of the proposed development, of 58 dBA and 59 dBA for daytime and night-time respectively.

During the worst-case hour (07:00-08:00) the average ( $L_{eq}$ ) façade-corrected noise level was recorded to be 54 dBA at this position.

### 11.3 Assumptions

Our calculations and noise models are based on the following assumptions

- Measured existing environmental noise levels as reported in section 2
- Predicted traffic movements for a typical day and worst-case hour, as advised by Motion
- Predicted delivery noise based on baseline data for vehicle movements from RBA database, as detailed in Appendix B.
- Road traffic movements unrelated to the new development will be similar to the existing conditions, i.e. the development will not result in any significant change to existing traffic flows
- Noise propagation is based on point source distance losses
- No corrections are required for atmospheric or weather conditions due to the short distances involved

### 11.4 Traffic Flows

Motion have advised the following assumptions can be made with regards to predicted road traffic movements serving the new development:

- Up to 20 deliveries/collections in a typical day
- All deliveries/collections will be during daytime hours (07:00-23:00)
- Up to 60% of deliveries/collections will occur in the worst-case hour
- The worst-case hour will be 07:00 – 08:00

### 11.5 Assessment

Using the information provided by Motion and SEL and  $L_{eq}$  data previously collected from measuring delivery noise a predicted increase in noise levels at the residential windows of the 4<sup>th</sup> floor of the proposed development can be made.

## 11.6 Assessment Results

We have assessed the effect of the proposed scheme at the nearest residential property at the proposed development, which we consider to be representative of the worst-affected situation.

The findings of our assessments are provided below in Table 8358/T14.

8358/T14 – Predicted Levels at Receptor due to Noise from Deliveries

| Period                        | Average Noise Level $L_{eq, period}$ (dBA) | Predicted Total Noise Level (dBA) | Increase (dB) |
|-------------------------------|--------------------------------------------|-----------------------------------|---------------|
| Full Day (07:00-23:00)        | 58                                         | 58                                | 0             |
| Worst-Case Hour (07:00-08:00) | 54                                         | 55                                | 1             |

## 11.7 Discussion of Results

As can be seen from Table 8358/T14 there is no increase in the average noise over the course of the typical operational day and an increase in 1 dB in the worst-case hour of 07:00-08:00. Referring to Tables 8358/T10-T11 shows that the deliveries have “no impact” over the over the course of the typical operational day and that the deliveries have a “negligible impact” with “no discernible effect on residents”.

## 11.8 Summary

In summary, the worst-case predicted noise levels results in an increase in the total noise level of 1 dB. In accordance with Tables 8358/T10-T11 this is increase is shown to have a negligible impact with no discernible effect on residents.

## 12.0 CONCLUSIONS

### 12.1 Plant Noise Emissions

RBA Acoustics have undertaken noise monitoring at the proposed development site at the Bristol & West Arcade, and 27 – 32 Market Place, Reading. The measured noise levels are presented herein. The resultant noise levels have been used to propose plant noise emission criteria for future assessment of any proposed plant at the development in accordance with typical Local Authority requirements.

### 12.2 External Building Fabric

The data has also been used in our assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233 and WHO.

We do not consider planning approval should be rejected on the basis of adverse noise impact and can confirm internal noise levels can be effectively controlled by fairly simple glazing configurations on the whole. General guidance configurations have been suggested for the glazing constructions.

### 12.3 Internal Building Fabric

The proposed internal separating build-ups have also been assessed, and we suggest that they will be capable of achieving typically acceptable levels of sound insulation commensurate with their proposed uses.

### 12.4 Traffic Noise Impact

The data has also been used in our assessment of the traffic noise impact due to deliveries serving the proposed site. Our assessment shows this will have a negligible impact with no discernible effect to the worst-affected residents.

## Appendix A - Acoustic Terminology

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| dB(A)                                  | 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 dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible. |
| $L_{eq}$                               | $L_{eq}$ 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 (1 hour).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| $L_{Aeq}$                              | The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| $L_{An}$ (e.g. $L_{A10}$ , $L_{A90}$ ) | 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 $L_{10}$ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, $L_{90}$ is the average minimum level and is often used to describe the background noise.                                                                                                                                                                                                                                                                                                                           |
| $L_{max,T}$                            | The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the $L_{eq}$ value.                                                                                                                                                                                                                                                                                                    |

# Appendix B – Traffic Noise Data

| Activity                             | Leq (dB) | SEL | Lmax (dB) | Distance (m) | Event Time (seconds) |
|--------------------------------------|----------|-----|-----------|--------------|----------------------|
| Entering Access Road and Manoeuvring | 75       | 77  | 88        | 3            | 25                   |
| Car Door Slamming                    | 64       | 64  | 72.0      | 3            | 1                    |
| Unloading                            | 59       | 80  | 74        | 25           | 300                  |
| Van Departing                        | 70       | 77  | 79        | 4            | 10                   |

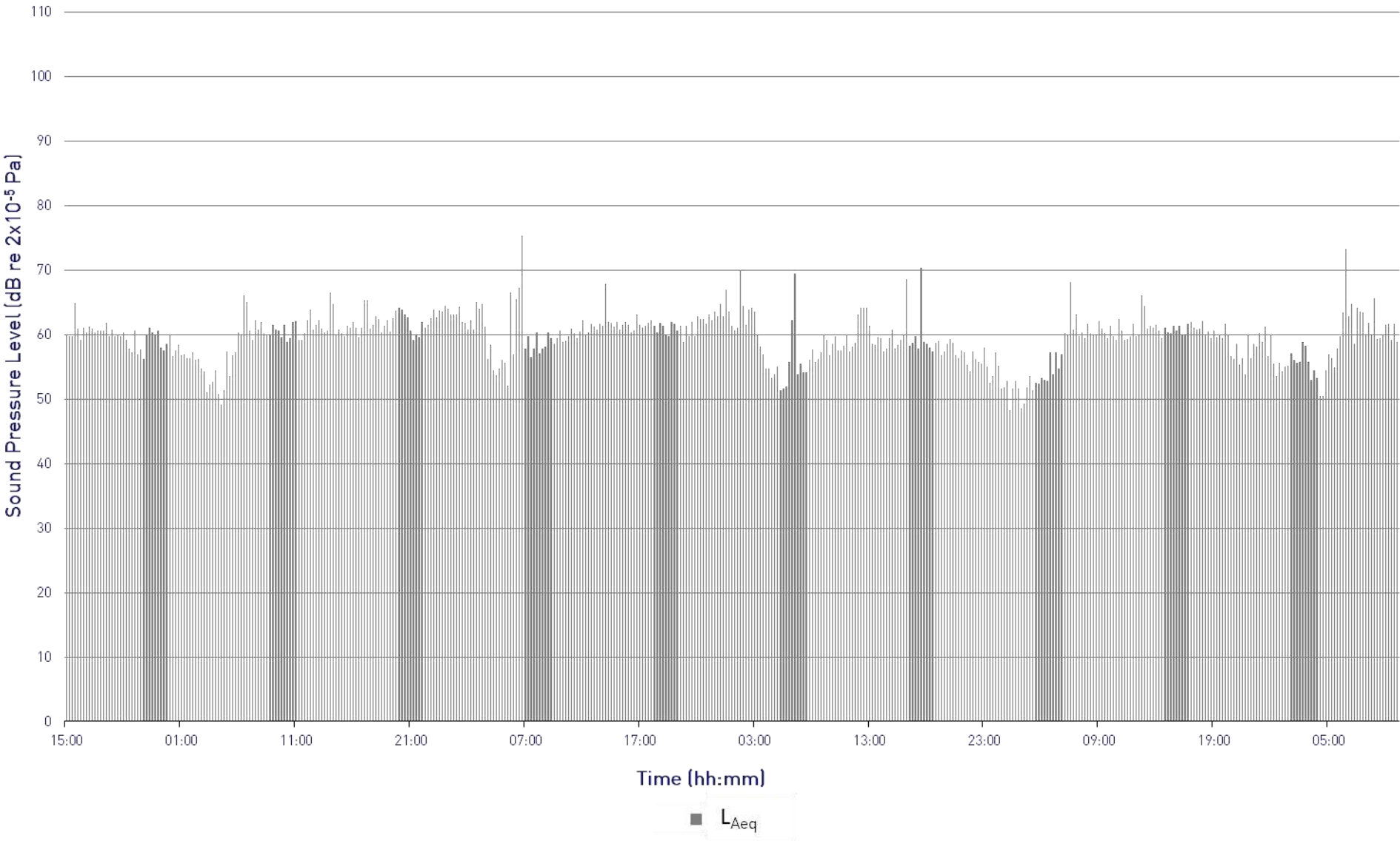
Bristol & West Arcade

L<sub>Aeq</sub> Time History

Measurement Position 1, Thursday 25 January - Tuesday 30 January 2018



Graph 8358/G1



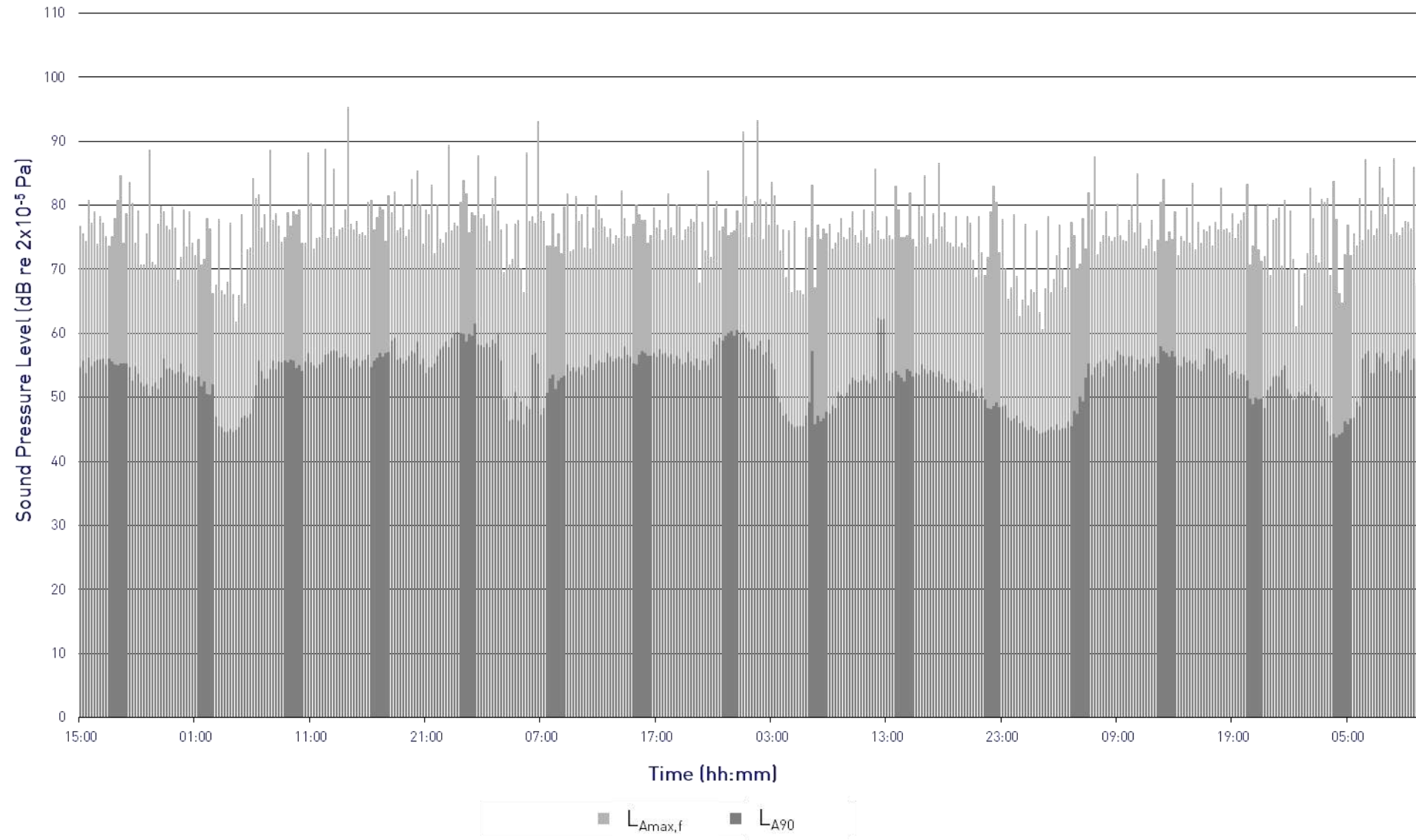
Bristol & West Arcade

$L_{Amax,f}$  and  $L_{A90}$  Time History

Measurement Position 1, Thursday 25 January - Tuesday 30 January 2018



Graph 8358/G2



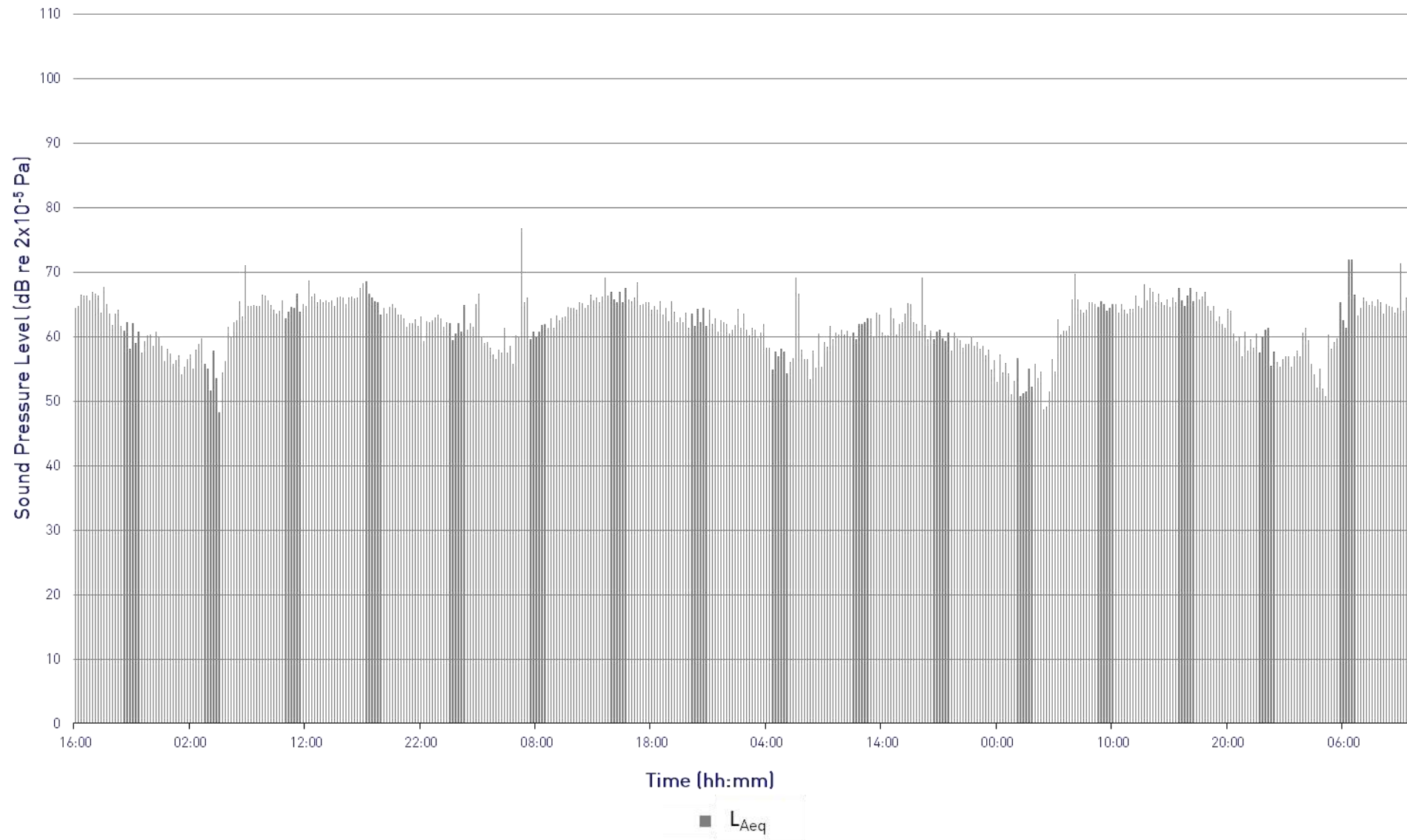
Bristol & West Arcade

$L_{Aeq}$  Time History

Measurement Position 2, Thursday 25 January to Tuesday 30 January, 2018



Graph 8358/G3



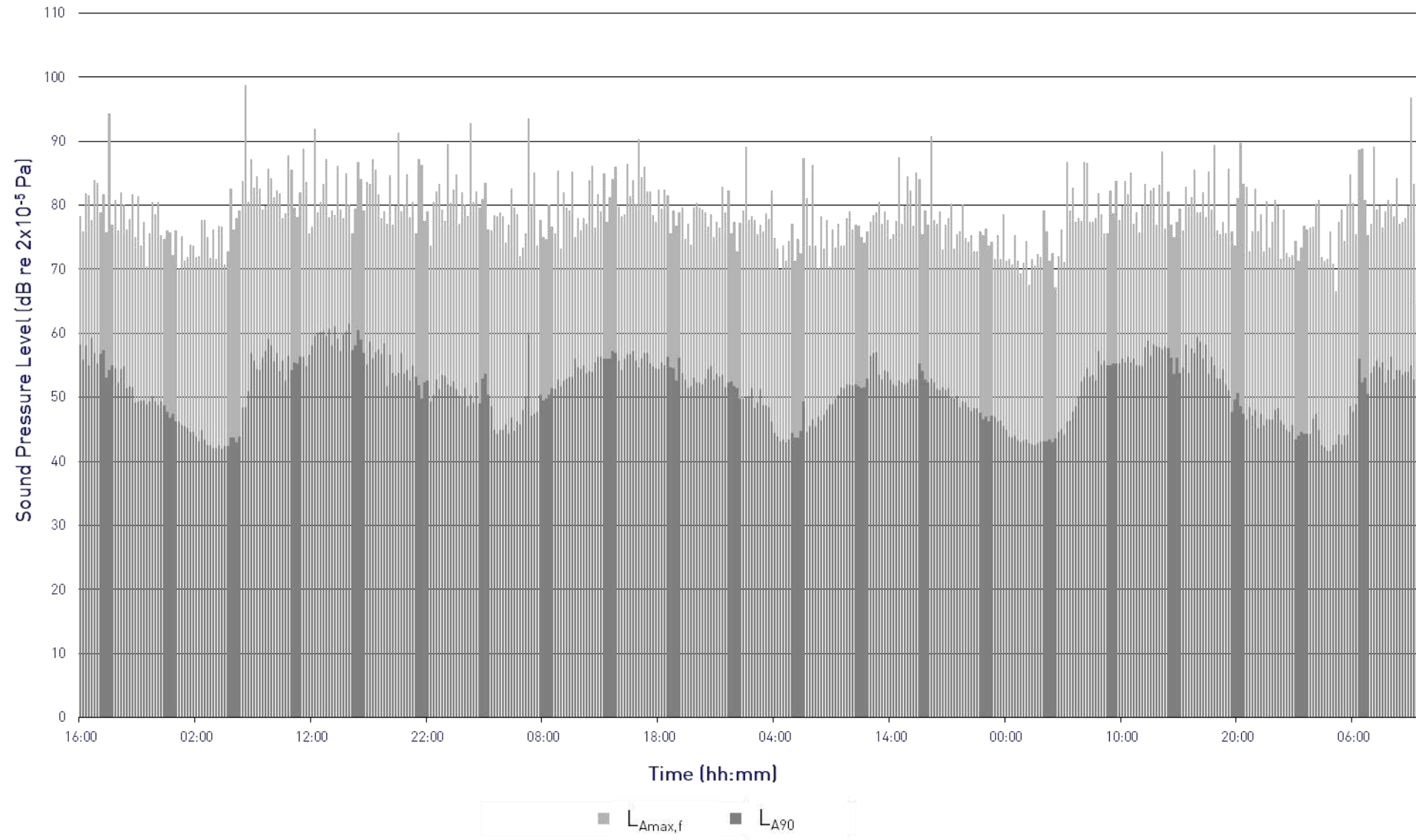
Bristol & West Arcade

$L_{Amax,f}$  and  $L_{A90}$  Time History

Measurement Position 2, Thursday 25 January to Tuesday 30 January, 2018



Graph 8358/G4



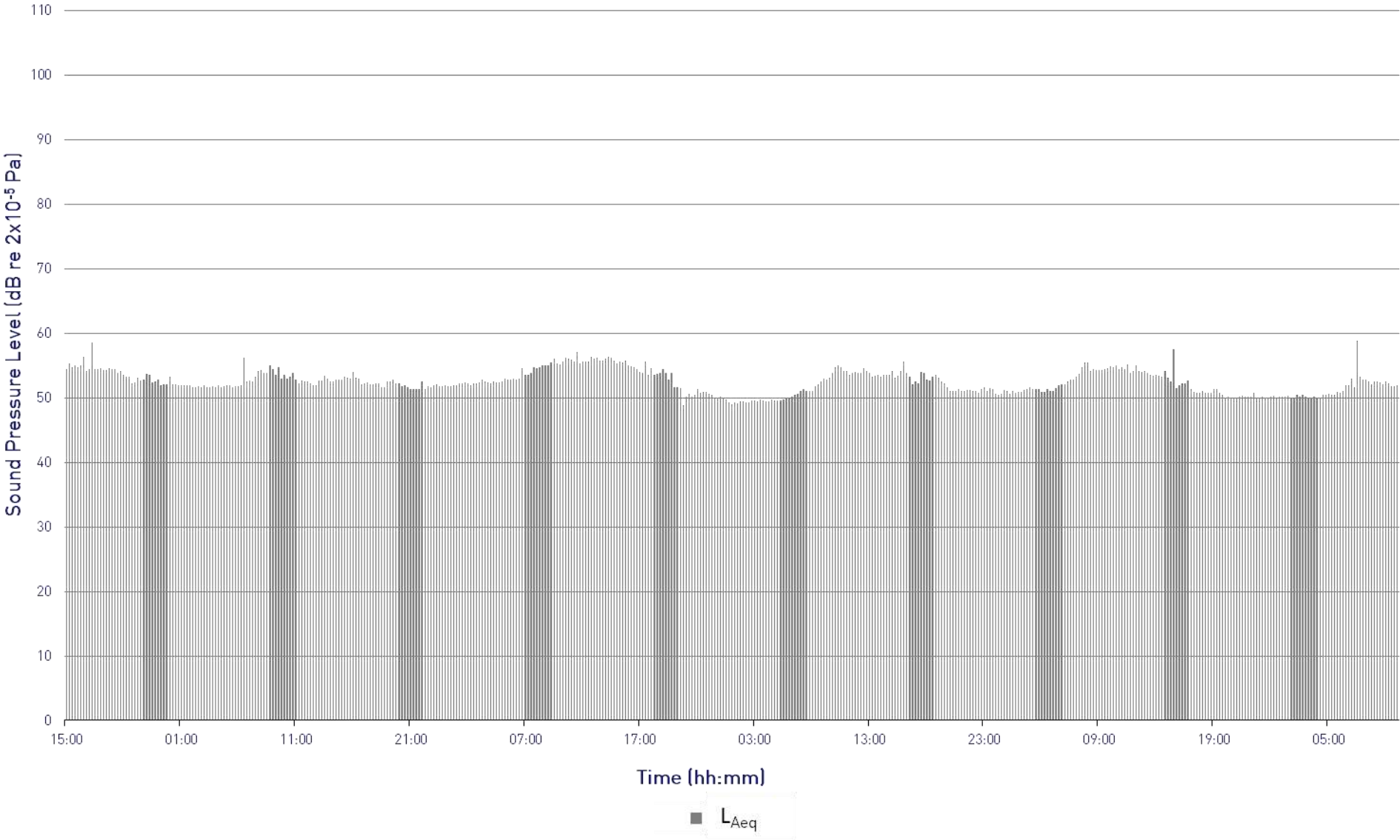
Bristol & West Arcade

L<sub>Aeq</sub> Time History

Measurement Position 3, Thursday 25 January to Tuesday 30 January 2018



Graph 8358/G5



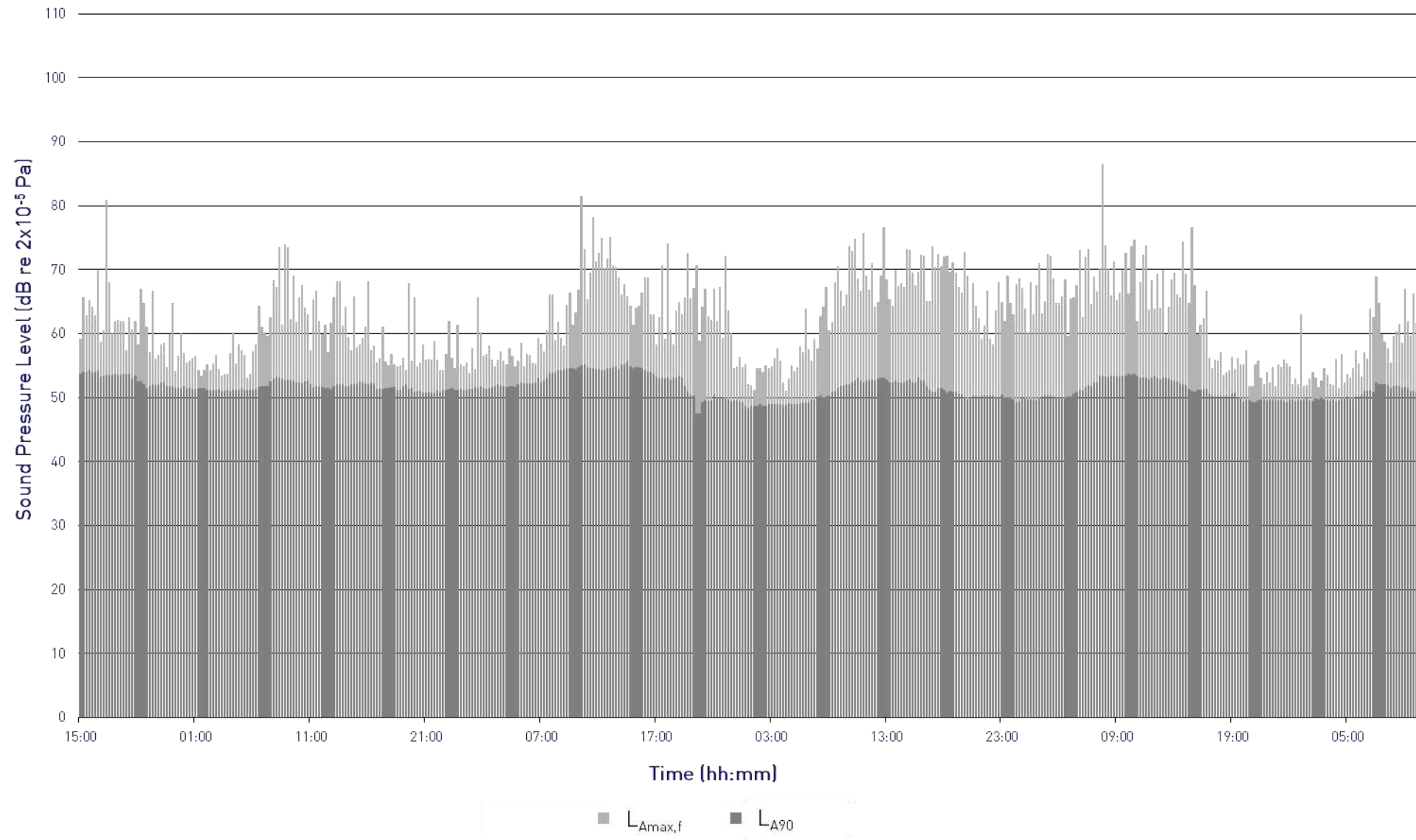
Bristol & West Arcade

$L_{Amax,f}$  and  $L_{A90}$  Time History

Measurement Position 3, Thursday 25 January to Tuesday 30 January 2018



Graph 8358/G6



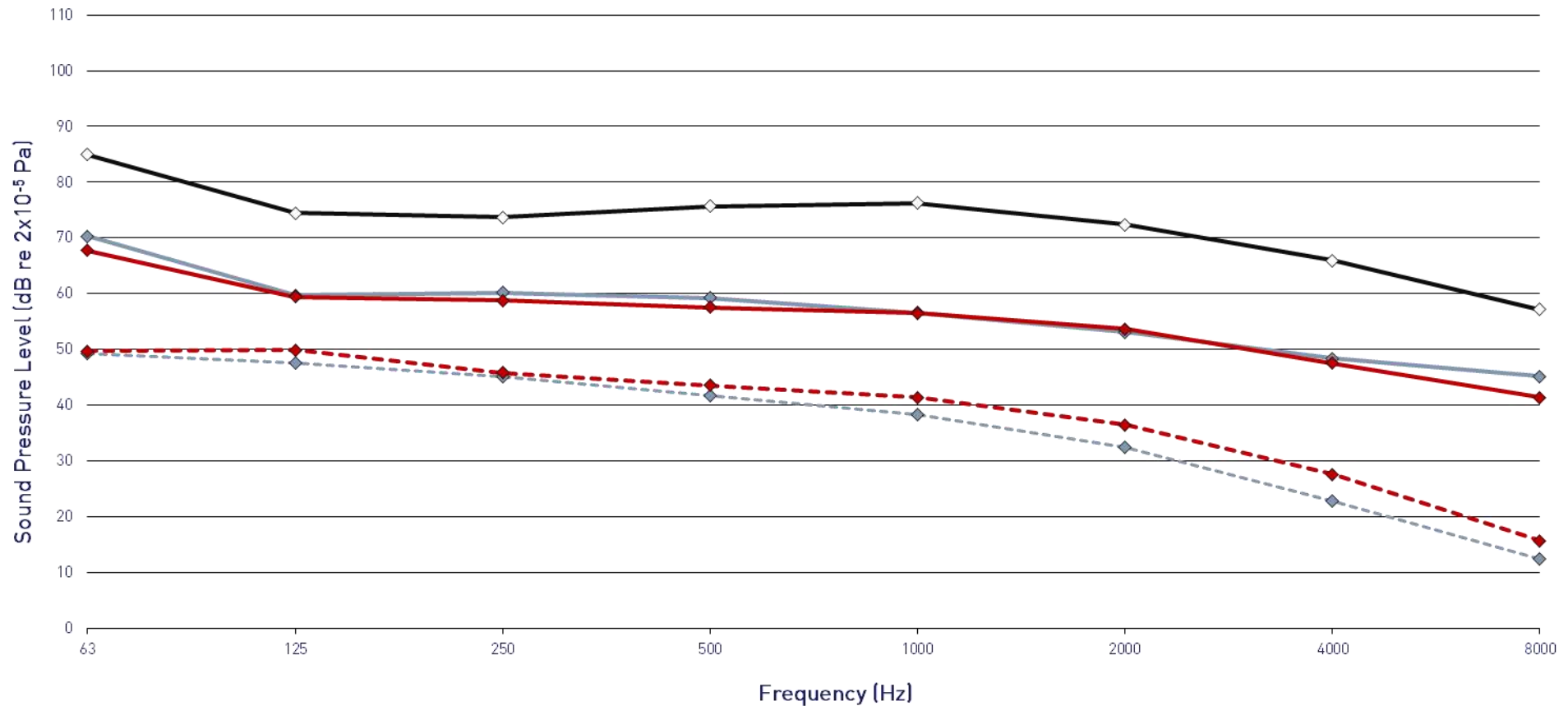
Bristol & West Arcade

Spectral Noise Levels

Measurement Position 1, Thursday 25 January - Tuesday 30 January 2018



Graph 8358/G7



---◇--- Minimum Night-time L90

---◇--- Minimum Daytime L90

—◇— Average Night-time Leq

—◇— Average Daytime Leq

—◇— Typical Lmax,f

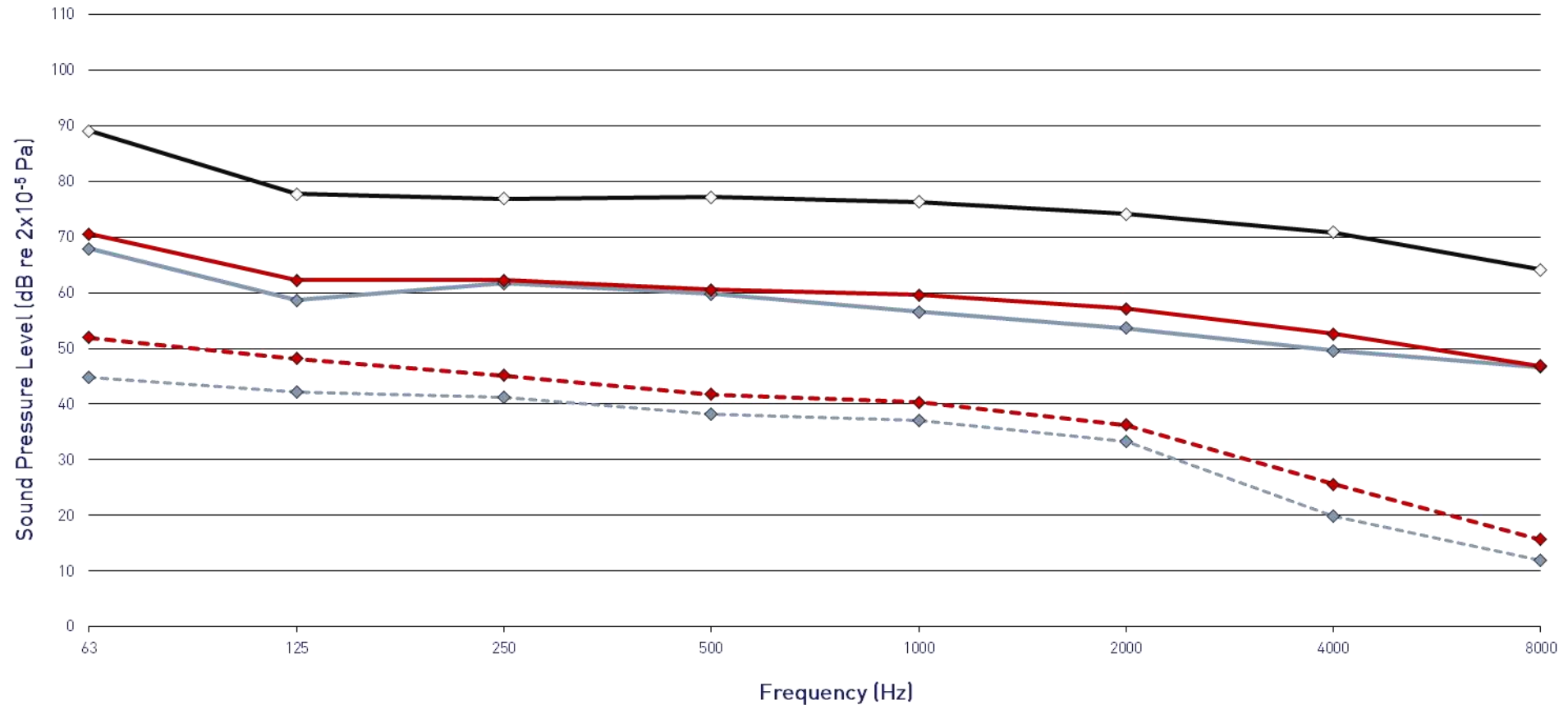
Bristol & West Arcade

Spectral Noise Levels

Measurement Position 2, Thursday 25 January to Tuesday 30 January, 2018



Graph 8358/G8



---◇--- Minimum Night-time L<sub>90</sub>

---◇--- Minimum Daytime L<sub>90</sub>

---◇--- Average Night-time Leq

---◇--- Average Daytime Leq

---◇--- Typical L<sub>max,f</sub>

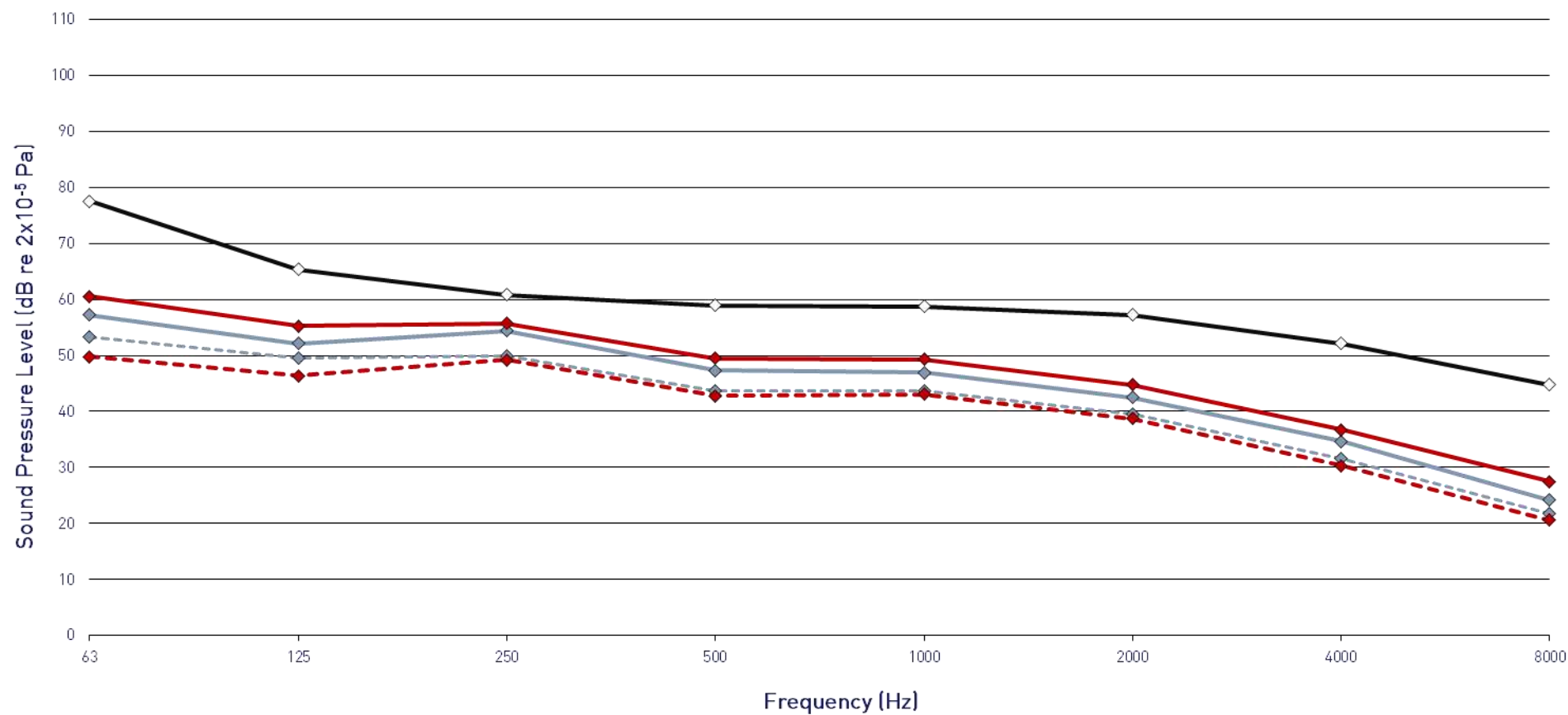
Bristol & West Arcade

Spectral Noise Levels

Measurement Position 3, Thursday 25 January to Tuesday 30 January 2018



Graph 8358/G9



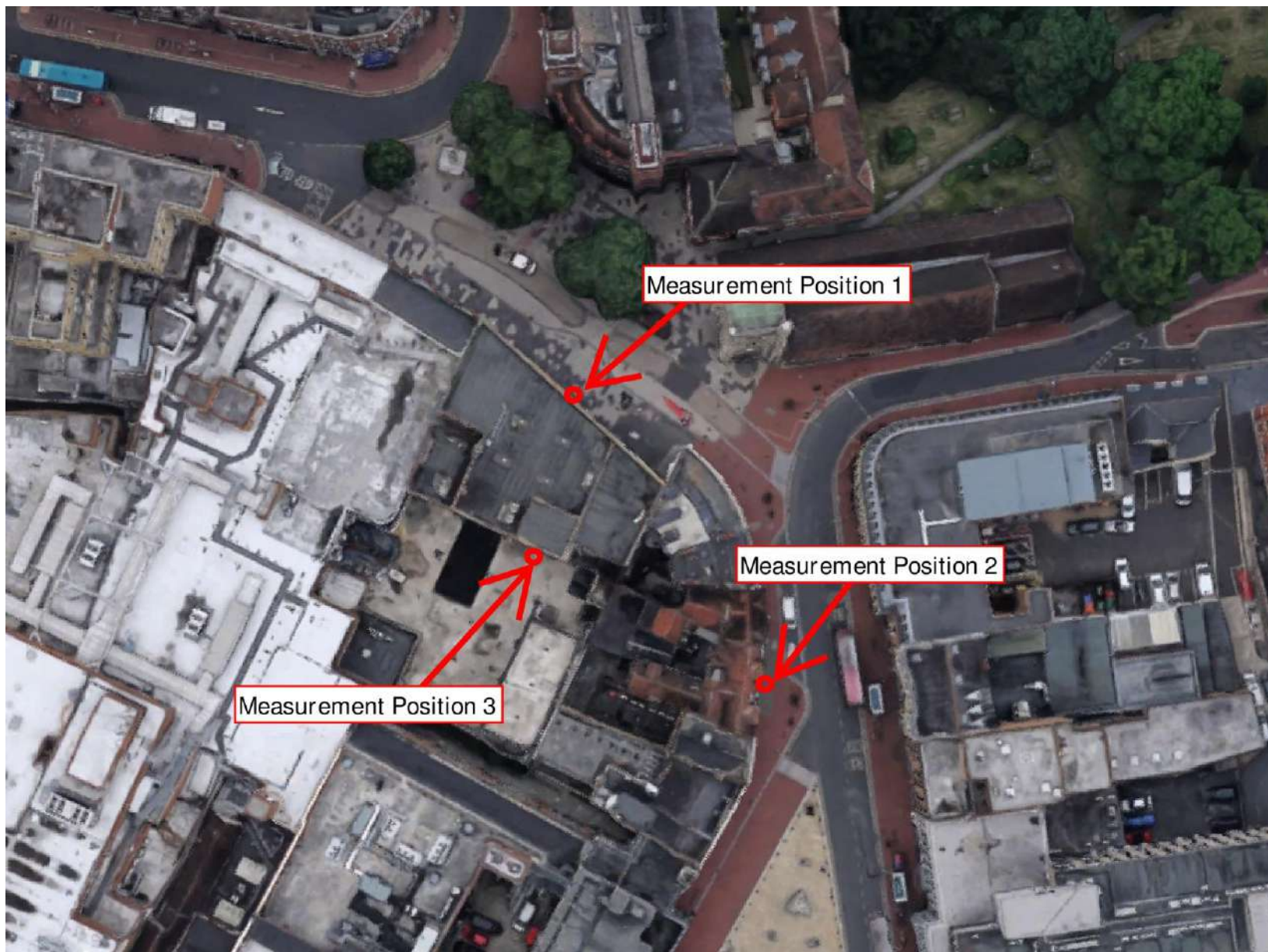
Minimum Night-time L<sub>90</sub>

Minimum Daytime L<sub>90</sub>

Average Night-time Leq

Average Daytime Leq

Typical L<sub>max,f</sub>



BRISTOL & WEST ARCADE, READING

Site Plan Showing Measurement Positions

8358/SP1

13 February 2018

Not to Scale





BRISTOL & WEST ARCADE, READING

Photograph detailing Measurement Position 1

Measurement Position 1

8358/P1

13 February 2018





BRISTOL & WEST ARCADE, READING

Photograph detailing Measurement Position 2

Measurement Position 2

8358/P2

13 February 2018





BRISTOL & WEST ARCADE, READING

Photograph detailing Measurement Position 3

Measurement Position 3

8358/P3

13 February 2018



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