

Report

19 January 2017



TEMPLE

LEADERS IN ENVIRONMENT,
PLANNING & SUSTAINABILITY.

Report for – UCLH Charity Middlesex Annex Camden Acoustic Assessment



Document Version Control

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Contents

1.0	Introduction	1
2.0	Site Description	2
3.0	Design Criteria	3
3.1	National Planning Policy Framework (2012)	3
3.2	The Noise Policy Statement for England (2010)	3
3.3	The London Plan (2015)	4
3.4	Camden Development Policies 2010-2025	5
3.5	British Standard 8233 (2014)	5
3.6	British Standard 4142 (2014)	6
4.0	Existing Acoustic Environment	7
4.1	Survey Description	7
4.2	Sound Measurement Results	8
4.3	Site Suitability	9
5.0	Control of Sound Intrusion	10
5.1	Building Envelope Sound Insulation	10
5.2	External Amenity Areas	11
6.0	Control of Sound Emission	12
7.0	Conclusion	13

Appendices

Appendix A	Glossary of Acoustic Terminology	15
Appendix B	Detailed Results of the Acoustic Survey	16

1.0 Introduction

Temple Group Ltd (Temple) was instructed by University College London Hospitals Charity (UCLHC) to undertake an acoustic assessment in order to support a planning application for the proposed development located at Middlesex Annex Camden.

The proposed development comprises three main elements. Firstly the part-demolition of the existing hospital annex building with the listed part of the structure, the former Strand Union Workhouse fronting onto Cleveland Street, being retained and refurbished as a mix of high quality residential units. Secondly, the existing buildings to the north and south of the listed Workhouse and also fronting onto Cleveland Street are to be retained and refurbished to provide a mix of market and affordable housing units. All other existing buildings on site will be demolished. Thirdly, to the rear of the retained Workhouse a new building is proposed; with its footprint enabling the reformation of the historic “Bedford passage through the southern part of the site. The building comprises of a mix uses including residential (Use Class C3) and business space (Use Class B1). In total the scheme will deliver 50 residential units over 3 to 8 storeys.

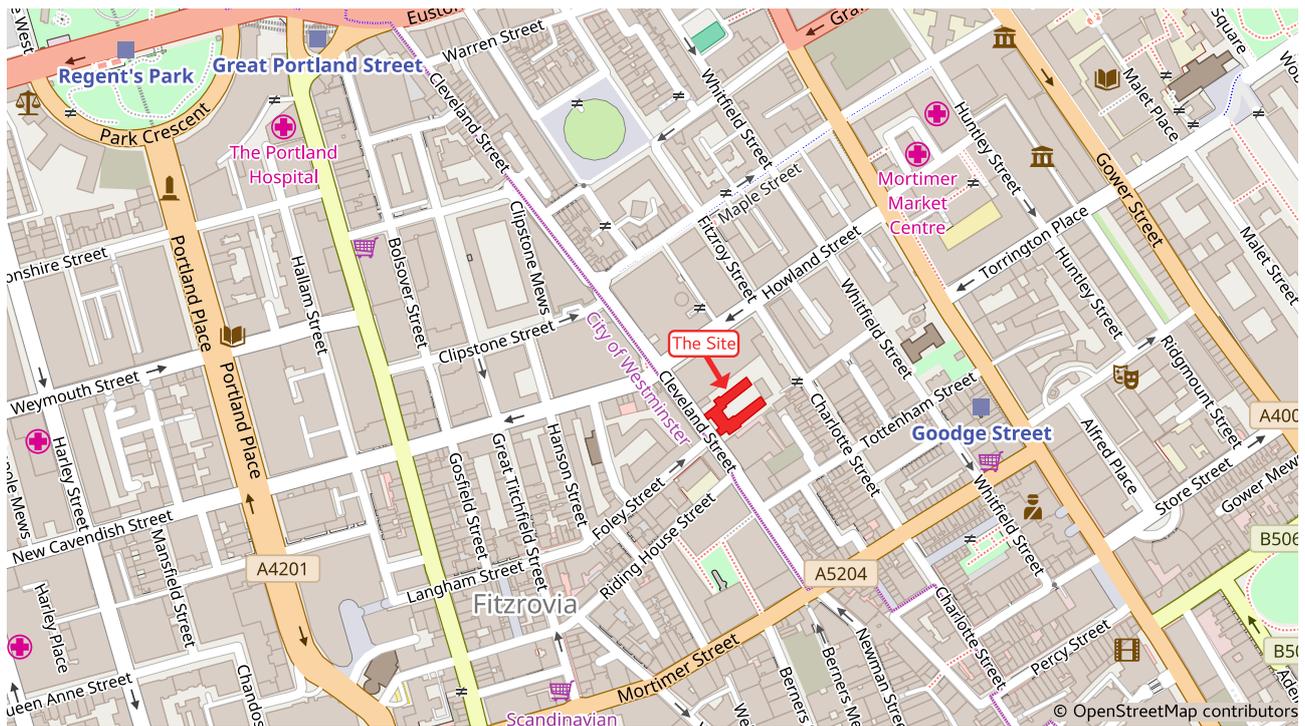
This assessment considers the key acoustic issues at the site and sets out the necessary measures that are required to ensure that the amenity of the occupants of the surrounding and proposed buildings is adequately protected against significant sound effects.

The following report contains references of a technical nature in order to assist the reader a glossary of acoustic terminology is included in Appendix A.

2.0 Site Description

The development site is located within in the Bloomsbury Ward of the London Borough of Camden (LBC). Situated at 44 Cleveland Street, it lies south of Howland Street, north of Tottenham Street and Tottenham Mews and west of Charlotte Street. Figure 1 shows the site location.

Figure 1 – Location of the Development Site



The site currently comprises a four-storey Workhouse, which fronts onto Cleveland Street. The building is set behind a tall boundary wall. Behind the Workhouse two wings of a similar height extend eastwards, forming a courtyard. Two three-storey buildings sit on the site boundaries to the north and south of this, referred to as the North and South Houses respectively.

3.0 Design Criteria

3.1 National Planning Policy Framework (2012)

The National Planning Policy Framework¹ (NPPF) aims to make planning less complex, more accessible, protect the environment and promote sustainable growth. The NPPF states the following requirements with regard to noise:

- *'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; and*
- *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.'*

3.2 The Noise Policy Statement for England (2010)

The Noise Policy Statement for England² (NPSE) is the overarching statement of noise policy for England. It applies to all forms of noise other than occupational noise and sets out the long term vision of 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 vision is supported by the following aims which are reflected in the aims for planning policies and decisions in Paragraph 123 of the NPPF:

'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.'*

The Explanatory Note to the NPSE introduces three concepts for the assessment of the potential effects of noise:

- *'NOEL - No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.'*
- *LOAEL - Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.'*
- *SOAEL - Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.'*

The three levels are not defined numerically in the NPSE and for the SOAEL the NPSE makes it clear that the sound level is likely to vary depending upon the sound source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent a SOAEL for noise is acknowledged and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

3.3 The London Plan (2015)

The London Plan³ which is a spatial development strategy for London refers to noise on its Policy 7.15 Reducing and managing noise, improving and enhancing the acoustic environment and promoting appropriate soundscapes:

'Strategic

A - The transport, spatial and design policies of this plan will be implemented in order to reduce and manage noise to improve health and quality of life and support the objectives of the Mayor's Ambient Noise Strategy.

Planning decisions

B - Development proposals should seek to manage noise by:

- 1. avoiding significant adverse noise impacts on health and quality of life as a result of new development;*
- 2. mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens on existing businesses;*
- 3. improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquility);*
- 4. separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial development) through the use of distance, screening or internal layout – in preference to sole reliance on sound insulation;*
- 5. where it is not possible to achieve separation of noise sensitive development and noise sources, without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through the application of good acoustic design principles;*
- 6. having particular regard to the impact of aviation noise on noise sensitive development; and*
- 7. promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

London Development Framework preparation

C - Boroughs and others with relevant responsibilities should have policies to:

- 1. manage the impact of noise through the spatial distribution of noise making and noise sensitive uses; and*
- 2. identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations.'*

3.4 Camden Development Policies 2010-2025

The adopted Camden Development Policies 2010-2025⁴ contribute towards delivering the LBC Core Strategy by setting out detailed planning policies to be applied when determining applications for planning permission.

Development Policy 28 (DP28) – Noise and vibration states the following: *‘The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:*

- *development likely to generate noise pollution; or*
- *development sensitive to noise in locations with pollution, unless appropriate attenuation measures are provided.’*

It also states that the *‘Council will only grant permission for plant or machinery if it can be operated without causing harm to amenity’.*

Tables 1 and 2 are extracted from DP28 and include the LBC sound level thresholds for assessing applications.

Table 1 – Sound Levels on residential streets adjoining roads, measured 1 m from a sensitive façade

Description	Time Period	Planning permission will not be granted	Attenuation measures will be required
Ambient Sound Level	07:00-19:00	> 72 dB $L_{Aeq,12h}$	> 62 dB $L_{Aeq,12h}$
Ambient Sound Level	19:00-23:00	> 72 dB $L_{Aeq,4h}$	> 57 dB $L_{Aeq,4h}$
Ambient Sound Level	23:00-07:00	> 66 dB $L_{Aeq,8h}$	> 52 dB $L_{Aeq,1h}$
Individual Events	23:00-07:00	–	> 82 dB $L_{Amax,S}$

Table 2 –Sound Levels from plant and machinery, measured anytime (from 00:00 to 24:00) and 1 m from a sensitive façade

Description	Planning permission will not be granted
Sound that has no characteristic features	5 dB < $L_{A90,T}$
Sound that has a distinguishable discrete continuous note	10 dB < $L_{A90,T}$
Sound that has distinct impulses	10 dB < $L_{A90,T}$
Background sound level is high, i.e. $L_{A90,T} > 60$ dB	55 dB $L_{Aeq,T}$

3.5 British Standard 8233 (2014)

The British Standard 8233:2014⁵ (BS8233) provides guidance on suitable internal sound levels for residential and commercial buildings. The specified criteria are generally in line with guidance given by the World Health Organisation: ‘Guidelines for Community Noise’⁶ document.

Table 3 presents the suitable internal sound levels for dwellings when they are unoccupied.

Table 3 – BS8233 Internal Ambient Sound Levels for Dwellings

Activity	Room	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16h}$	–
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	–
Sleeping	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

A note in BS8233 advises that regular individual events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic events could require separate values. For regular night time events, an internal guideline of 45 dB $L_{Amax,F}$ is frequently adopted as a guideline limit.

In addition, BS8233 states that for traditional external areas such as gardens and patios it is desirable that the external sound level does not exceed 50 dB $L_{Aeq,T}$, with an ‘upper guideline value’ of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

Table 4 presents the suitable internal sound levels for offices when they are unoccupied.

Table 4 – BS8233 Internal Ambient Sound Levels for Offices

Activity	Location	Design Range
Shared working space	Open plan office	45 – 50 dB $L_{Aeq,T}$
Study and work requiring concentration	Staff/meeting room	35 – 45 dB $L_{Aeq,T}$
Study and work requiring concentration	Executive office	35 – 40 dB $L_{Aeq,T}$

3.6 British Standard 4142 (2014)

The British Standard 4142:2014⁶ (BS4142) describes methods for rating sound of an industrial and/or commercial nature to assess its likely effects on people who might be inside or outside a dwelling or premises used for residential purposes upon which the sound is incident.

BS4142 specifies that an initial estimate of the impact of the specific sound can be obtained by subtracting the measured background sound level from the rating level and then considering the following:

- Typically the greater this difference, the greater the magnitude of the impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The rating level is defined in BS4142 as the sound level of the source plus any penalties for the characteristic features of the sound, such as tonality and impulsivity among others.

4.0 Existing Acoustic Environment

4.1 Survey Description

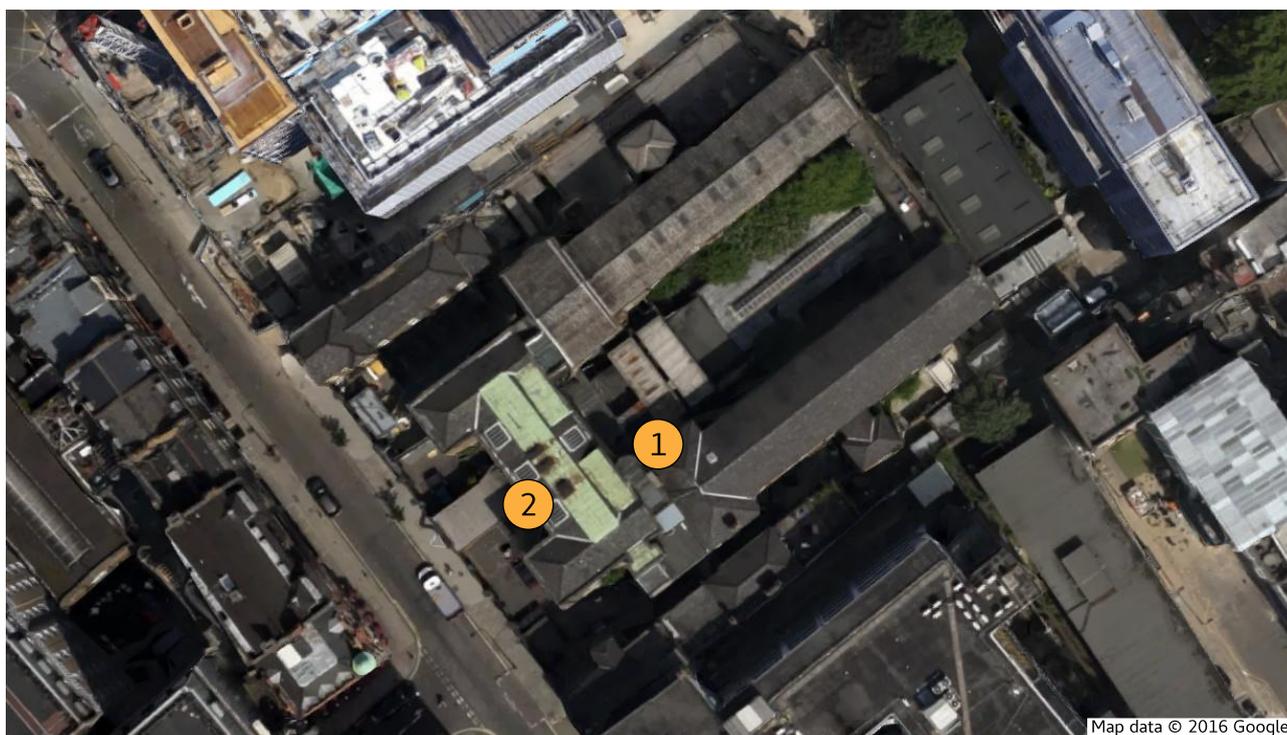
In order to establish the prevailing acoustic environment a survey was carried out at the site between Tuesday 11 and Friday 14 October 2016.

Sound measurements were undertaken on at the third floor of the existing building roof at two locations:

- Location 1 overlooking the rear part of the site; and
- Location 2 overlooking Cleveland Street.

These locations, illustrated in Figure 2, were considered suitable to obtain data which would be representative of the typical acoustic conditions in the area.

Figure 2 – Sound Measurement Locations



Sound measurements were carried out at 1 m away from the building façades and are therefore deemed to have been taken under façade conditions.

The equipment used comprised two Rion NA-28 sound level meters calibrated with a Rion NC-74 acoustic calibrator. The instruments used are designed to be in compliance with the requirements of the Class 1 standard for accuracy as defined with the British Standards 60942⁸ and 61672⁹. Laboratory calibration of the equipment was conducted no more than two years before the period of the survey. In all cases the microphones were fitted with windshields suitable for outdoor use.

The sound level meters were setup to record levels every second in terms of $L_{Aeq,T}$, $L_{Amax,F}$, $L_{Amax,S}$ and $L_{feq,T}$ (in third octave band), the obtained data was subsequently post-processed. The meters were also checked for sensitivity and no variations greater than 0.2 dB were noted.

The weather during the survey period was generally sunny and dry and wind speed was considered to be less than 5 m s^{-1} , based upon the prevailing weather conditions.

4.2 Sound Measurement Results

This section summarises the results of the sound measurements undertaken during the acoustic survey. Tables 5 and 6 present the ambient, background and maximum sound levels. They are expressed as overall single figures value (dB(A)) and in octave band from 63 to 8000 Hz. Detailed graphical results are included in Appendix B.

Table 5 – Ambient, Background and Maximum Sound Levels, dB (re 20 μPa)

Location	Date	Time Period	Ambient Sound Level, $L_{Aeq,T}$	Background Sound Level, $L_{A90,T}$	Maximum Sound Level, $L_{Amax,F}$
1	2016-10-11	13:00-19:00	46	44	65
1	2016-10-11	19:00-23:00	43	41	65
1	2016-10-11	23:00-07:00	42	38	67
1	2016-10-12	07:00-19:00	51	44	70
1	2016-10-12	19:00-23:00	44	42	64
1	2016-10-12	23:00-07:00	43	39	59
1	2016-10-13	07:00-19:00	48	44	68
1	2016-10-13	19:00-23:00	47	43	63
1	2016-10-13	23:00-07:00	45	39	65
2	2016-10-11	13:00-19:00	59	52	79
2	2016-10-11	19:00-23:00	56	47	72
2	2016-10-11	23:00-07:00	50	41	73
2	2016-10-12	07:00-19:00	60	51	81
2	2016-10-12	19:00-23:00	56	47	75
2	2016-10-12	23:00-07:00	52	42	72
2	2016-10-13	07:00-19:00	60	52	81
2	2016-10-13	19:00-23:00	62	56	80
2	2016-10-13	23:00-07:00	51	42	75

Table 6 – Ambient Sound Levels, dB (re 20 µPa) (Octave Band)

Location	Time Period	Ambient Sound Level, $L_{req,T}$ Octave Band Frequency, Hz							
		63	125	250	500	1000	2000	4000	8000
1	07:00-19:00	55	53	49	47	44	39	29	19
1	19:00-23:00	52	51	46	43	40	34	24	15
1	23:00-07:00	51	49	44	41	38	32	25	18
2	07:00-19:00	64	62	56	56	55	52	50	42
2	19:00-23:00	61	60	56	54	54	48	44	35
2	23:00-07:00	57	54	49	47	47	42	39	30

The measurements have been affected by an alarm sounding inside the building on Wednesday 12 October 2016 from 19h56 for approximately 12 minutes. This period has been excluded from the results.

The lowest background sound levels were measured at 02:30 on Wednesday 12 October 2016. They were of 38 and 41 dB $L_{A90,15min}$ at Locations 1 and 2 respectively.

At both Locations, no event exceeded 82 dB $L_{Amax,S}$ during the night-time periods.

4.3 Site Suitability

Based on the acoustic survey results (presented in Table 5) and with regards to the London Borough of Camden criteria (described in Table 1), attenuation measures will be required in order to meet the requirements of the Local Authority.

5.0 Control of Sound Intrusion

5.1 Building Envelope Sound Insulation

The proposed development will be subject to sound mainly from road traffic on Cleveland Street. This section of the report considers the sound levels expected within the proposed development, as a result of the existing acoustic environment. It also provides advice on the sound insulation performance requirements for the building façades in order to protect the amenity of the future occupants.

An assessment has been made to determine the level of sound insulation required to the key façade elements of the proposed buildings. The level of sound intrusion will depend on the acoustic performance of all the elements of the façade, but is generally determined by the components of least airborne sound resistance, which are usually the ventilation systems and glazing.

The area of glazing and method of ventilation in any particular room, along with the room size and room acoustic conditions, affects the degree of reduction in sound transmission from outside to inside. This assessment has been carried out using assumptions based on information made available to us at the time of writing. These may require reviewing during the detailed design stage.

The following assumptions have been used for the assessment of the sound insulation requirements of the proposed building envelope:

- External sound levels incident on the proposed building façades have been derived from the measurements described in Section 3 taking account of the proposed building layouts;
- Predictions have been made using the general method set out in BS EN 12354-3:2000¹⁰;
- The predictions assume good quality workmanship, for example that windows, doors and opening lights are well sealed. Poor workmanship or low quality seals may result in predicted internal sound levels being exceeded;
- External walls are of a brick/block cavity construction with a sound insulation value of at least 52 dB R_w and 48 dB R_{w+Ctr} ;
- The ventilation strategy is for natural ventilation;
- The number of background or trickle ventilators has a substantial influence on the sound insulation of the building envelope and this assessment assumes one ventilator per room. If more vents are required, the sound insulation value increases by $10 \times \log_{10}(N)$, where N is the number of vents;
- The area of glazing in any particular room, along with the room size and room acoustic conditions, affects the degree of reduction in sound transmission from outside to inside. Calculations are based on generic dimensions. Bedrooms are 4 m wide, 4 m length, 3 m height. Living rooms and offices are 6 m wide, 6 m length, 3 m height. Façade areas are glazed at 50 %; and
- The façade elements have been designed assuming closed windows.

The sound insulation requirements of the glazing are applicable to the window system as a whole including frames, mullions and panels. The sound insulation measurements for glazing and unit ventilators are based on BS EN ISO 10140-1:2010+A2:2014¹¹ and rated in accordance with BS EN ISO 717-1:2013¹².

Table 7 presents a preliminary analysis of the performance requirement for the windows.

Table 7 – Indicative Glazing and Ventilation Sound Reduction Performance Ratings

Glazing Unit	Ventilation Unit
29 dB R_w+C_{tr}	30 dB $D_{nE,w}+C_{tr}$

The performance values given in Table 7 should be treated as indicative and taken as a demonstration that acceptable internal sound levels can be achieved in practice with appropriate specification of façade components, mainly double glazed units and trickle vents.

5.2 External Amenity Areas

There are several external amenity areas serving the proposed residential buildings. The ambient sound levels measured at the rear of site at (Location 1) are below 50 dB $L_{Aeq,T}$, thus within the criteria defined in BS8233, described in Section 3. No further measures are required.

6.0 Control of Sound Emission

Sound emissions from the development, from any proposed external mechanical plant, will need to be controlled to achieve the acceptable levels, both within the development itself and in the surrounding areas.

It is proposed that the sound rating level, as defined in BS4142, emanating from any fixed building services plant should be limited to operate at least 5 dB below the background sound level.

The following limits were calculated:

Table 8 – Plant Sound Rating Limit

Time Period	Background Sound Level	Plant Sound Rating Limit
07:00-19:00 (Day)	44 dB $L_{A90,T}$	39 dB $L_{Aeq,T}$
19:00-23:00 (Evening)	41 dB $L_{A90,T}$	36 dB $L_{Aeq,T}$
23:00-07:00 (Night)	38 dB $L_{A90,T}$	33 dB $L_{Aeq,T}$

In order to ensure that sound emissions from building services plant is adequately controlled, standard techniques such as attenuation, screening or enclosures might be necessary.

However, precise details of the final selection of equipment for building services, if any, are not known at this stage so a detailed assessment with respect to criteria cannot be undertaken.

7.0 Conclusion

Temple Group Ltd has undertaken an assessment of potential acoustic constraints associated with the proposed residential development at Middlesex Annex Camden.

An acoustic survey was carried out in order to establish the prevailing acoustic environment at the site. The sound levels to which the proposed development will be exposed have been determined from the results of this survey.

Sound intrusion will be controlled by ensuring the façade and internal building elements satisfy the specified minimum sound insulation performance requirements set out in this report. Indicative performance values have been provided as a demonstration that acceptable internal sound levels can be achieved in practice with appropriate specification of façade components.

In order to minimise the risk of nuisance to the surrounding community during the operation of the development, an assessment has been undertaken and sound emission limits derived to ensure compliance with the London Borough of Camden acoustic criteria.

Based on this assessment and with the recommendations described in this report, it is concluded that the acoustic issues at the Site will be controlled and should not impede any decision to grant permission for the development of this site.

References

- ¹ Department for Communities and Local Government. *National Planning Policy Framework*. HMSO, London, 2012.
- ² Department for Environment, Food and Rural Affairs. *Noise Policy Statement for England*. HMSO, London, 2010.
- ³ Greater London Authority. *The London Plan: Spatial Development Strategy for London. Consolidated with alterations since 2011*. GLA, London, 2015.
- ⁴ London Borough of Camden. *Camden Development Policies 2010-2025 – Local Development Framework*. LBC, London, 2010.
- ⁵ British Standards Institute. BS 8233:2014. *Guidance on sound insulation and noise reduction for buildings*. BSI, London, 2014.
- ⁶ World Health Organisation. *Guidelines for Community Noise*. WHO, Geneva, 2000.
- ⁷ British Standards Institute. BS 4142:2014. *Method for rating and assessing industrial and commercial sound*. BSI, London, 2014.
- ⁸ British Standards Institute. BS EN 60942:2003. *Electroacoustics. Sound calibrators*. BSI, London, 2003.
- ⁹ British Standards Institute. BS EN 61672-1:2013. *Electroacoustics. Sound level meters. Specifications*. BSI, London, 2013.
- ¹⁰ British Standards Institute. BS EN 12354-3:2000. *Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound*. BSI, London, 2000.
- ¹¹ British Standards Institute. BS EN ISO 10140-1:2010+A2:2014. *Acoustics. Laboratory measurement of sound insulation of building elements. Part 1: Application rules for specific products*. BSI, London, 2014.
- ¹² British Standards Institute. BS EN ISO 717-1:2013. *Acoustics. Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation*. BSI, London, 2013.

Appendix A Glossary of Acoustic Terminology

Noise/Sound

Noise and sound need to be carefully distinguished. Sound is a term used to describe wave-like variations in air pressure that occur at frequencies that can stimulate receptors in the inner ear and, if sufficiently powerful, be appreciated at a conscious level. Noise implies the presence of sound but also implies a response to sound: noise is often defined as unwanted sound.

Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 20 μ Pa) and the threshold of pain is around 120 dB.

Frequency, Hz

Frequency is the number of occurrences of a repeating event per unit second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is usually divided up into octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency. The bands are described by their centre frequency value. In environmental acoustics the ranges typically used are from 63 Hz to 8 kHz.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

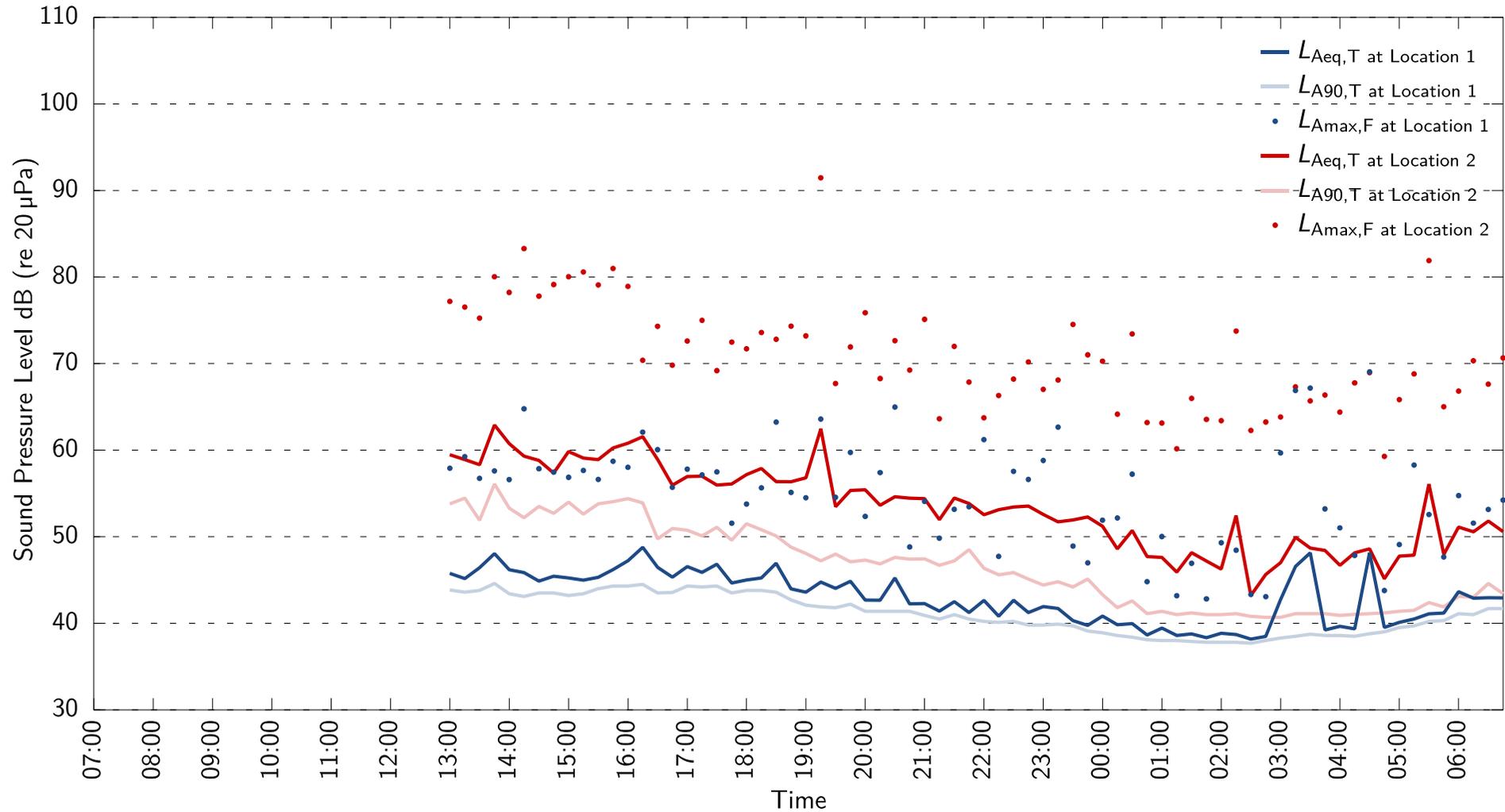
Acoustic Descriptors

Where sound levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

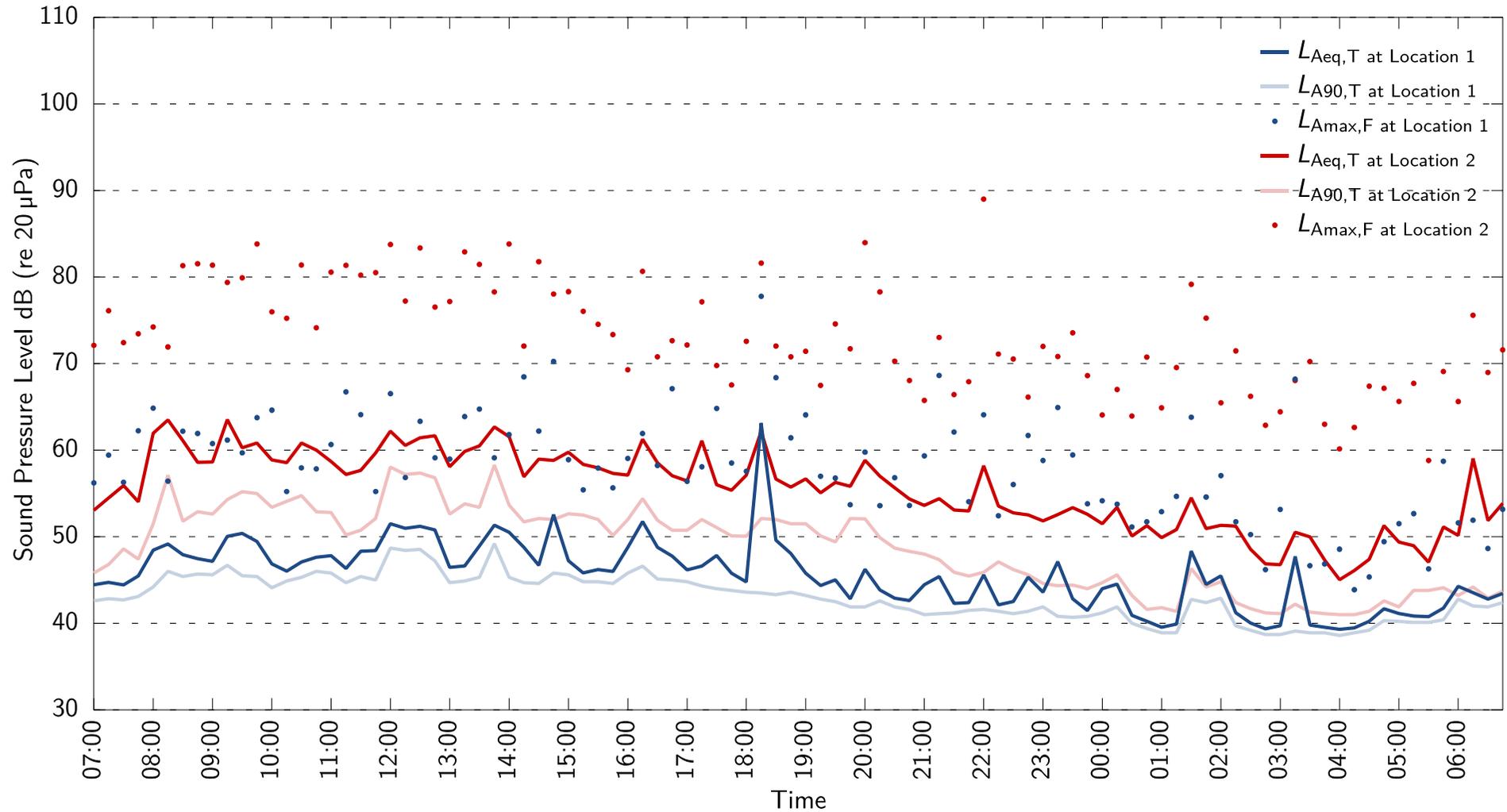
- $L_{eq,T}$ The most widely applicable unit is the equivalent continuous sound pressure level. It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same sound energy as the actual fluctuating sound.
- $L_{90,T}$ The level exceeded for 90% of the time is normally used to describe background sound.
- L_{max} The maximum sound pressure level associated with a time weighting: 'fast' or 'slow'.

Appendix B Detailed Results of the Acoustic Survey

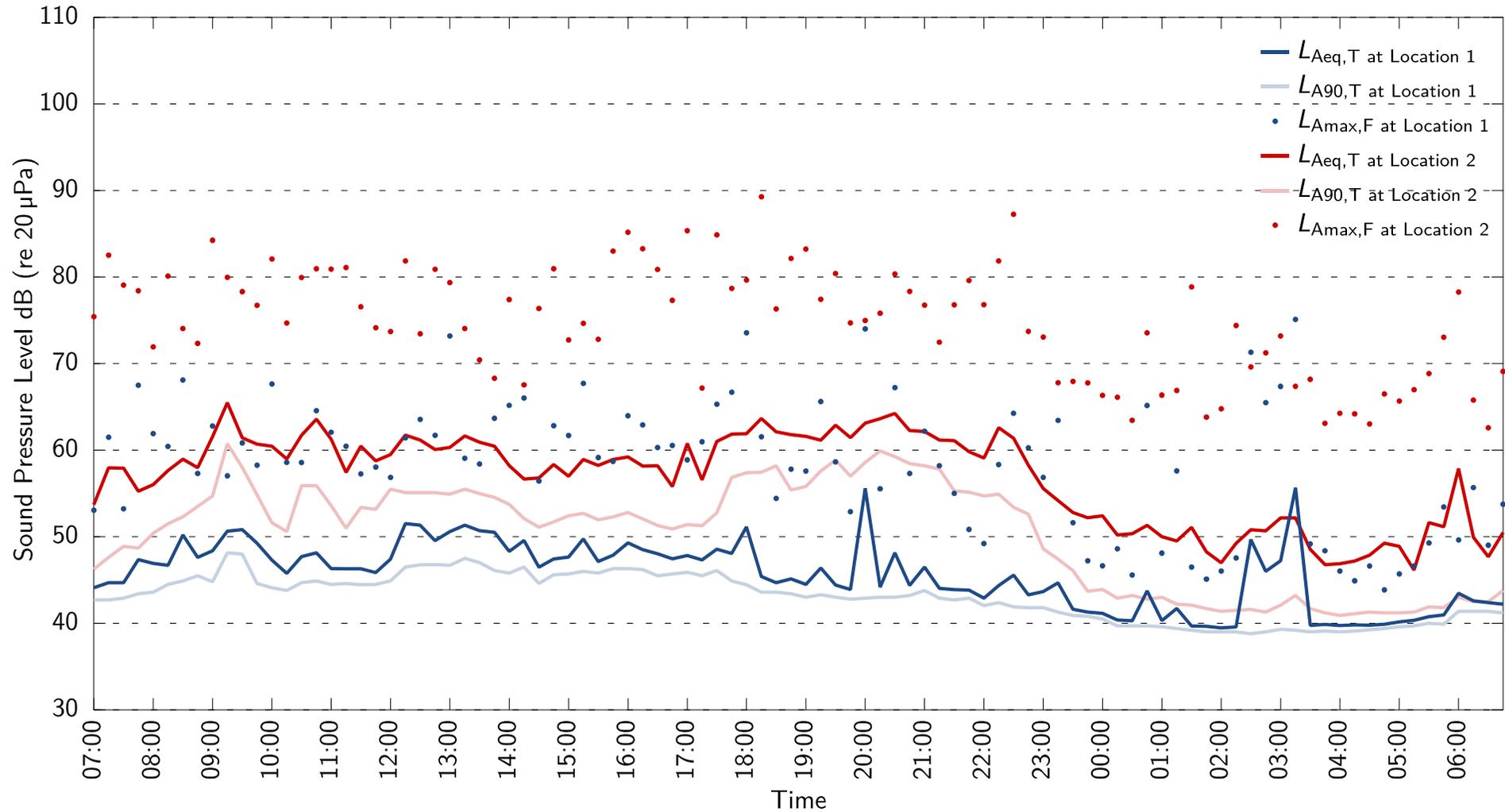
Sound Levels Measured on Tuesday 11 October 2016



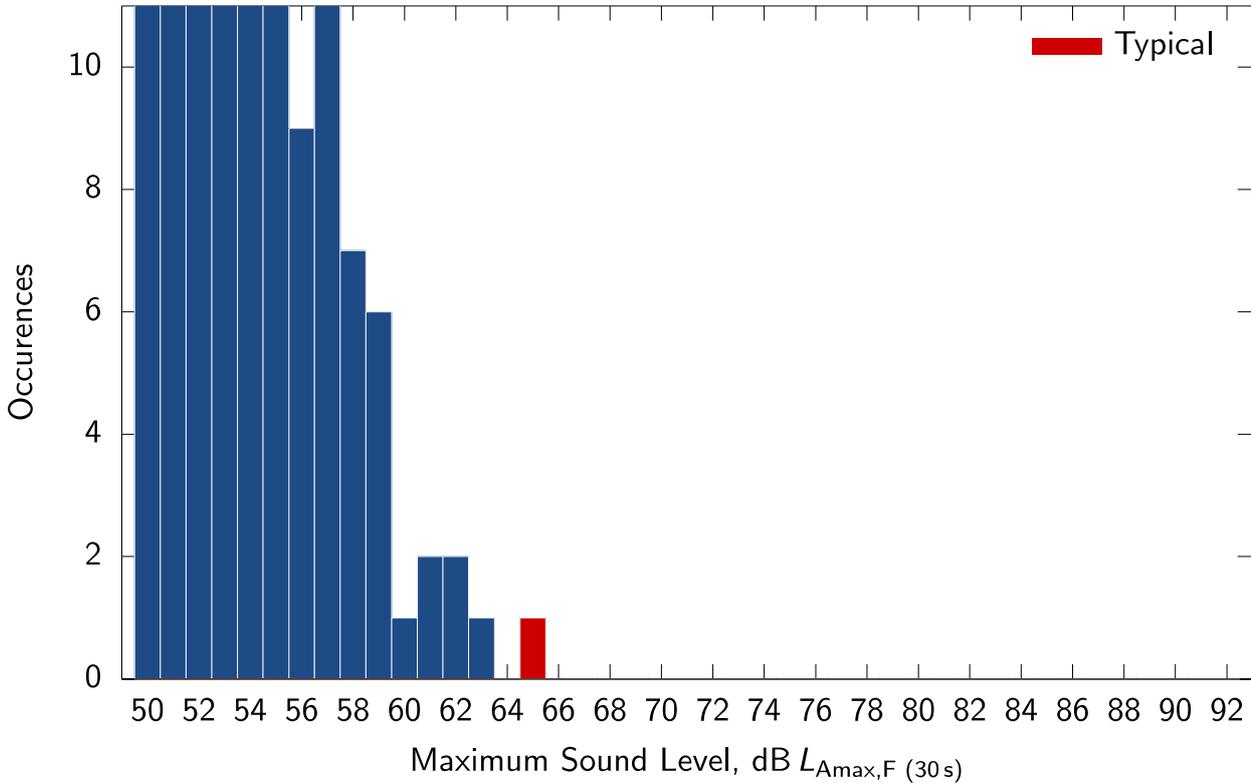
Sound Levels Measured on Wednesday 12 October 2016



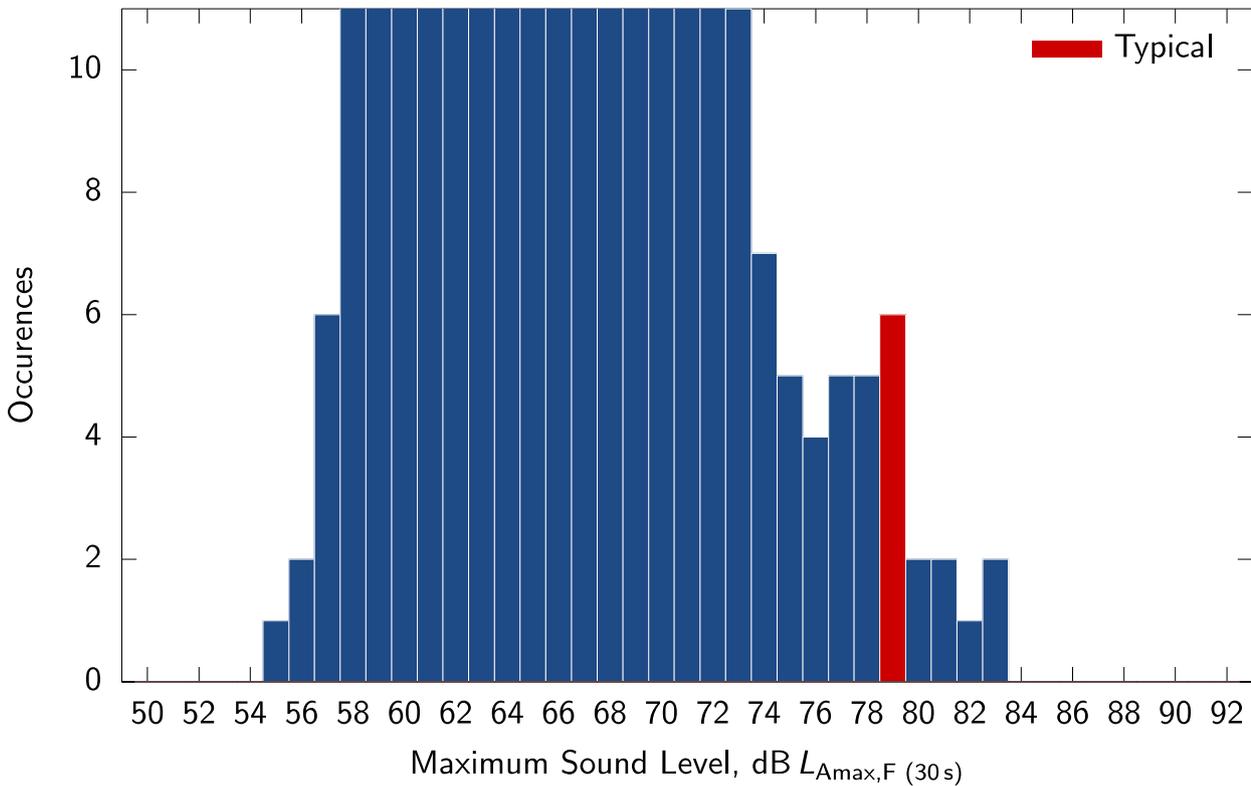
Sound Levels Measured on Thursday 13 October 2016



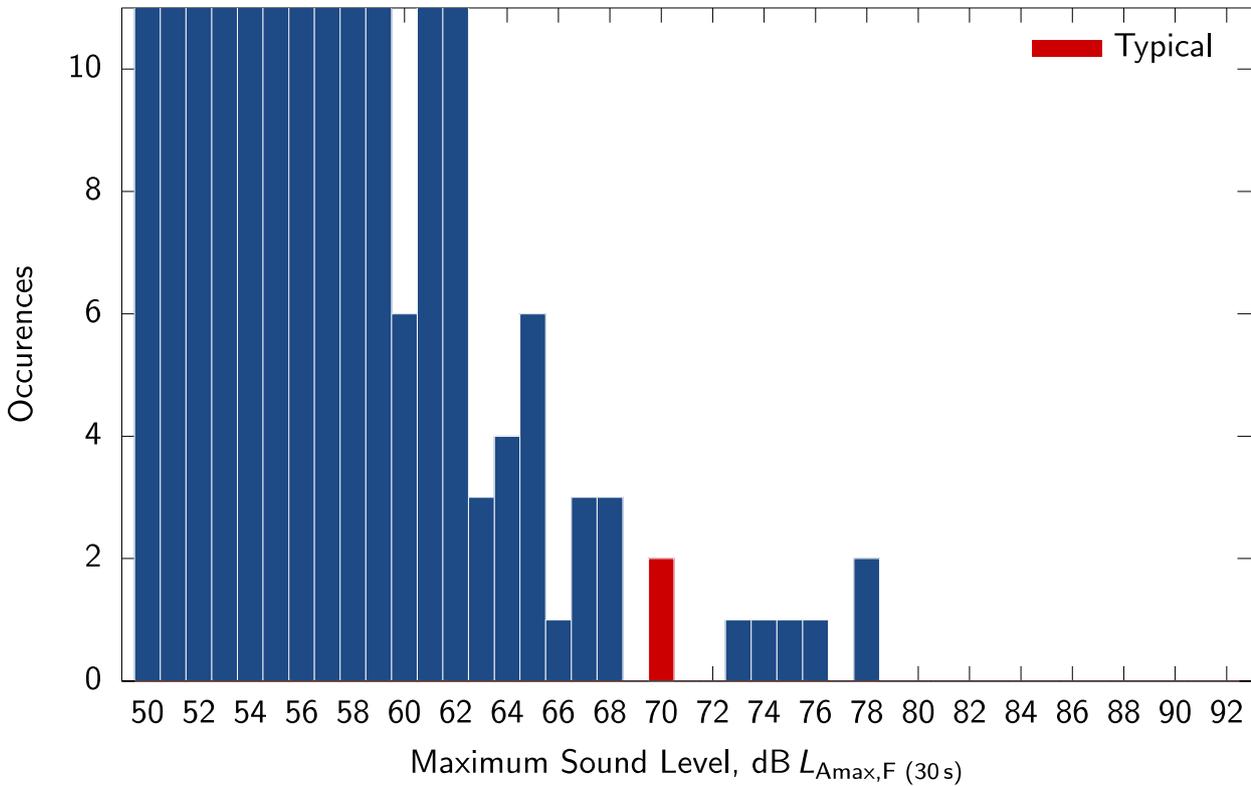
Daytime events measured on Tuesday 11 October 2016 at Location 1



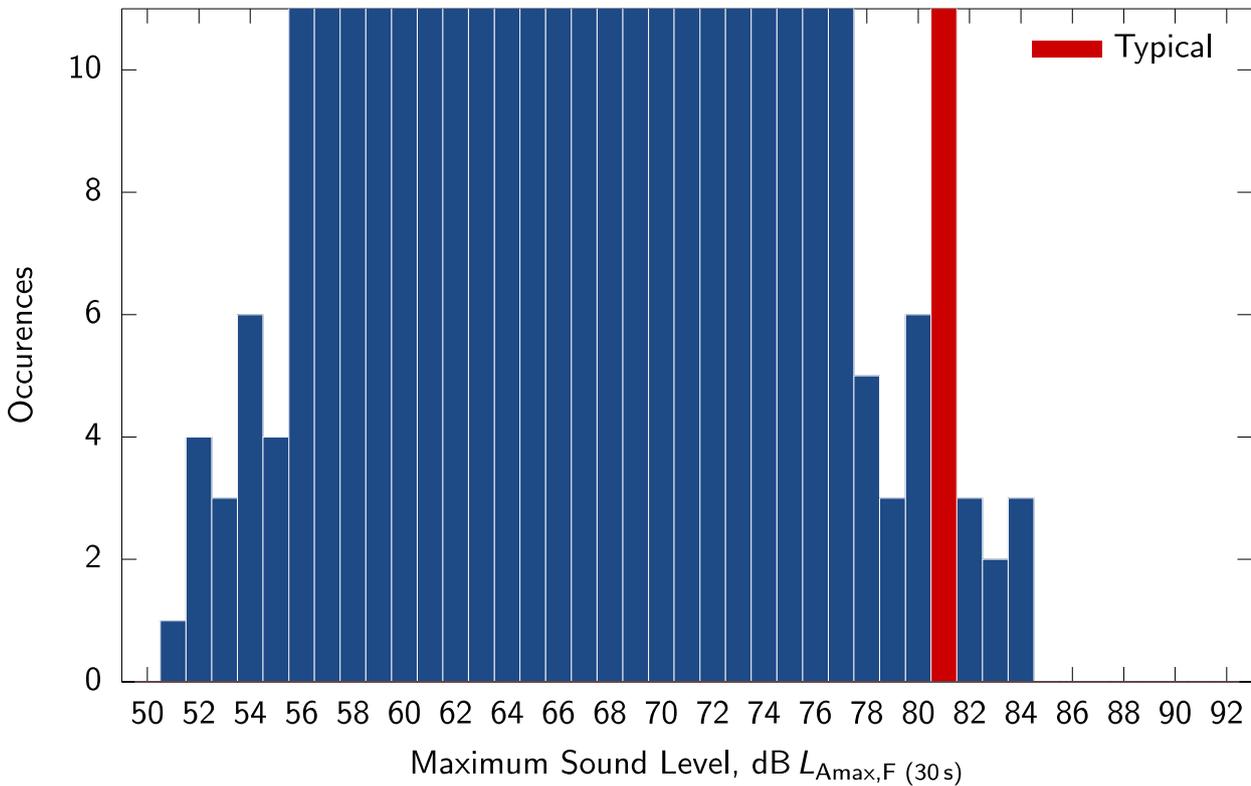
Daytime events measured on Tuesday 11 October 2016 at Location 2



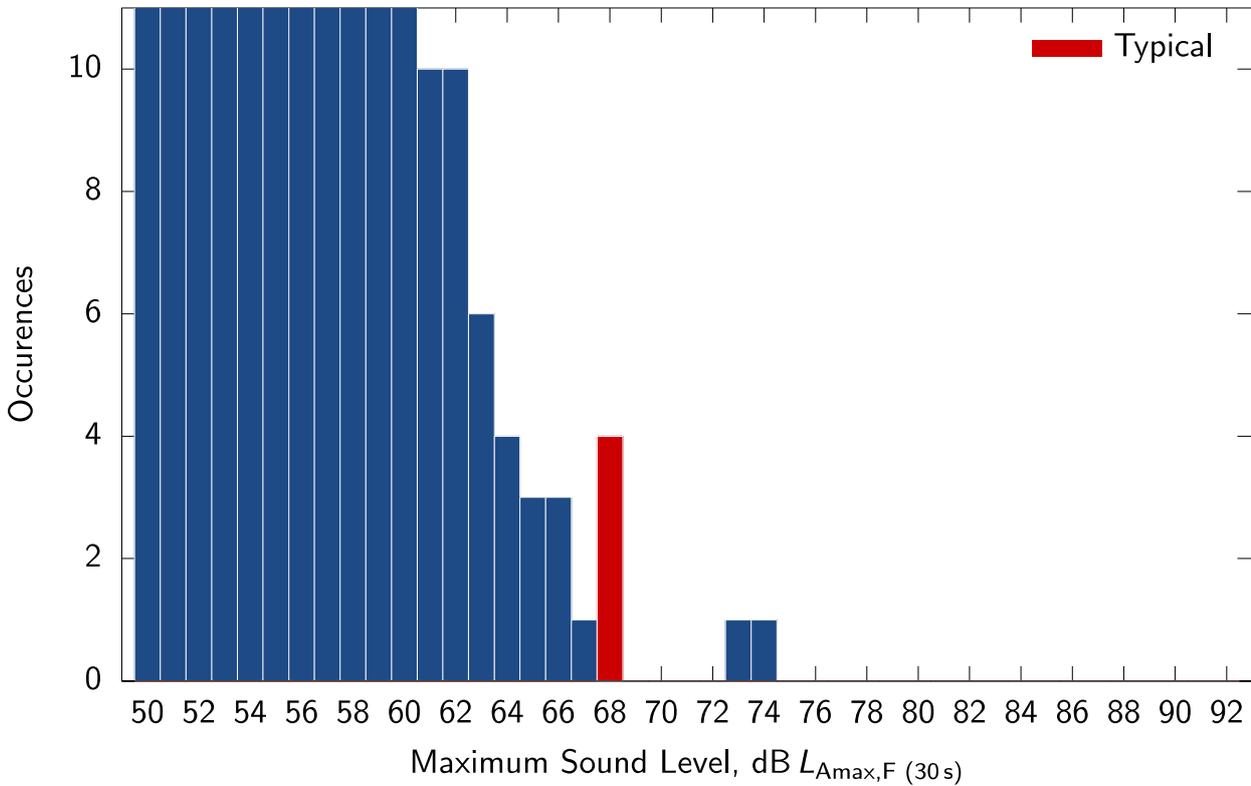
Daytime events measured on Wednesday 12 October 2016 at Location 1



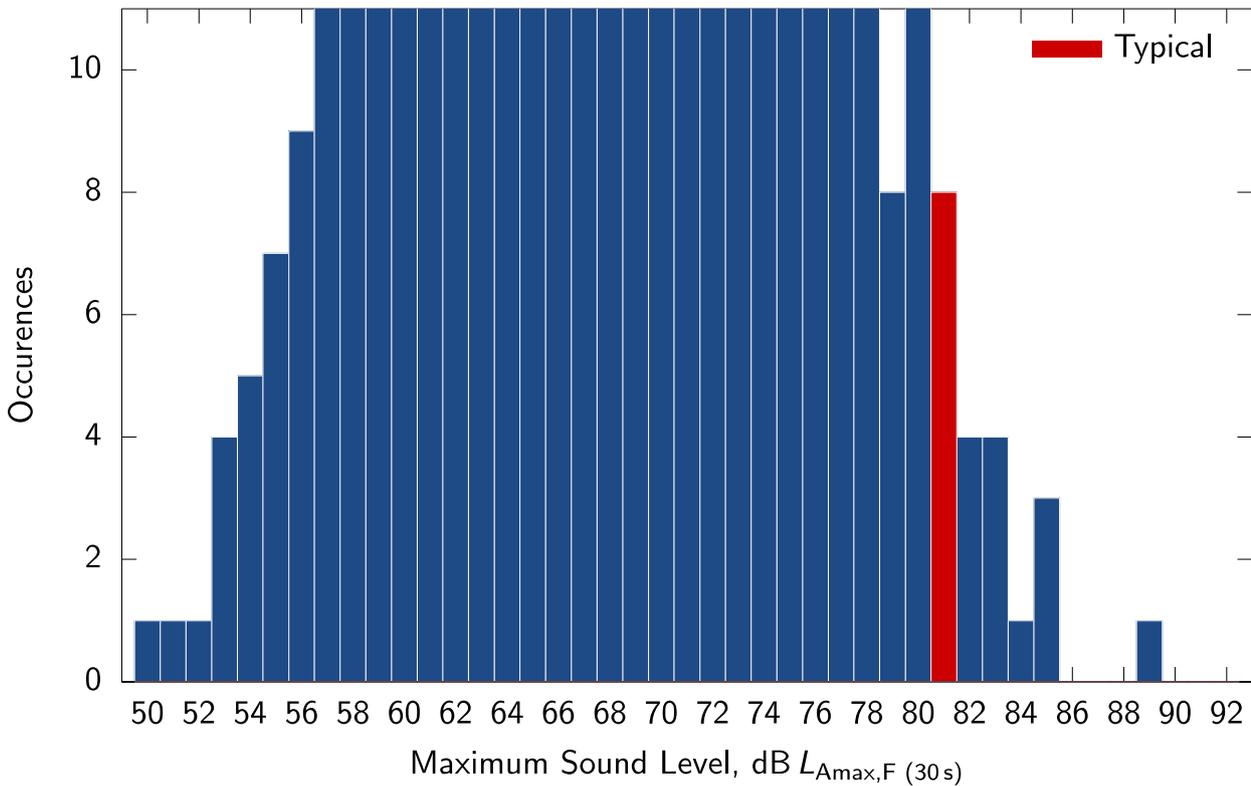
Daytime events measured on Wednesday 12 October 2016 at Location 2



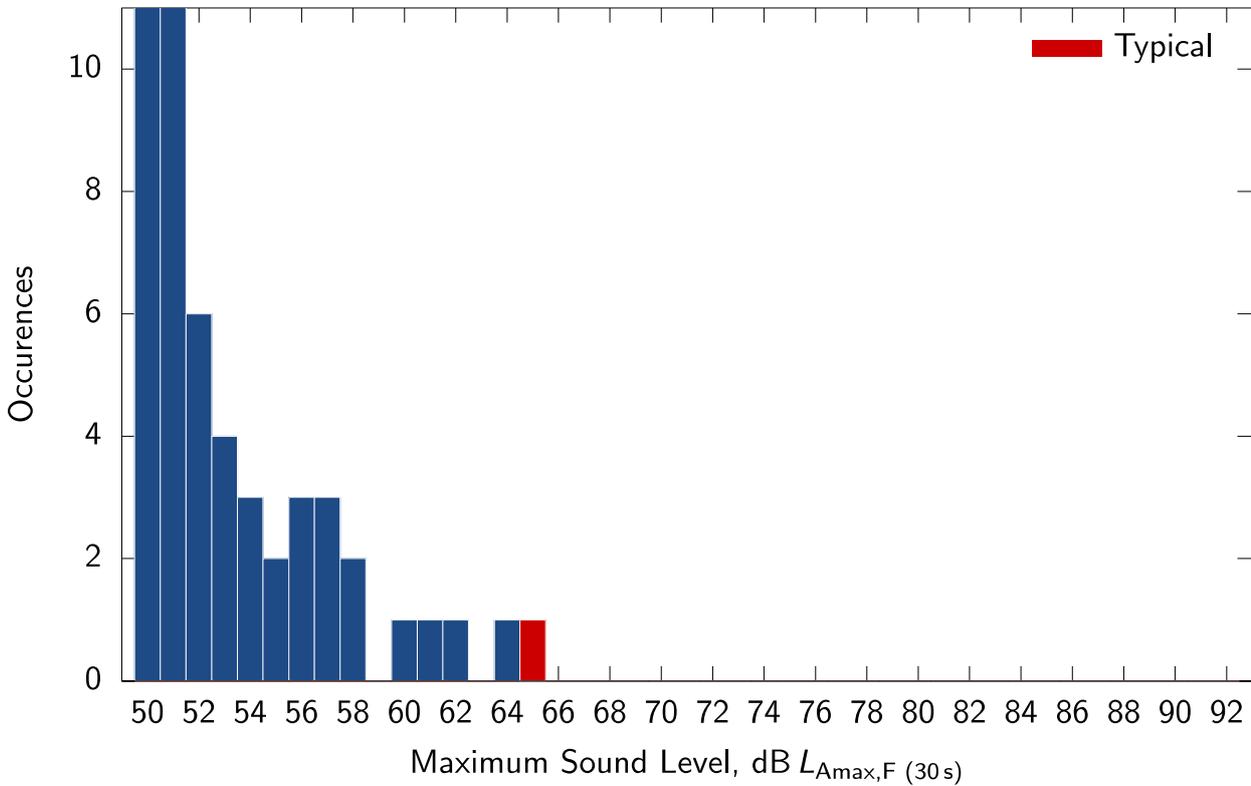
Daytime events measured on Thursday 13 October 2016 at Location 1



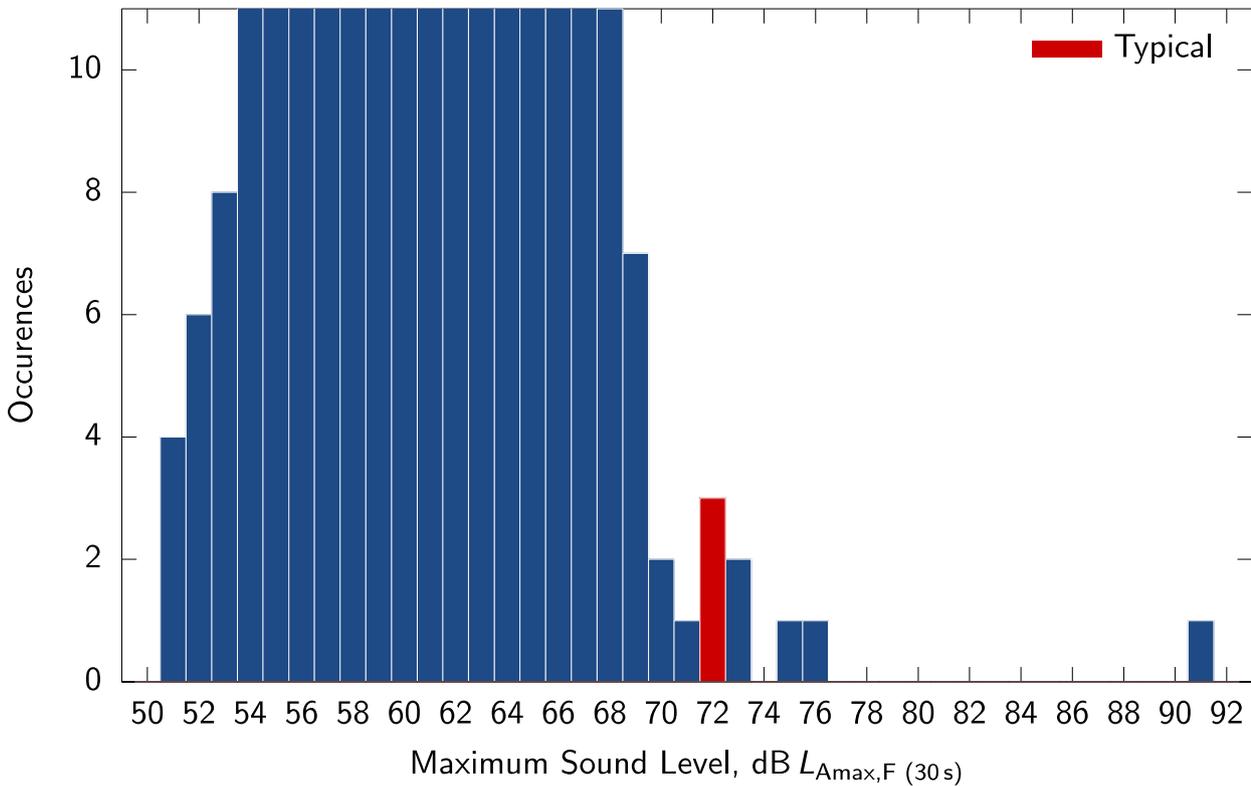
Daytime events measured on Thursday 13 October 2016 at Location 2



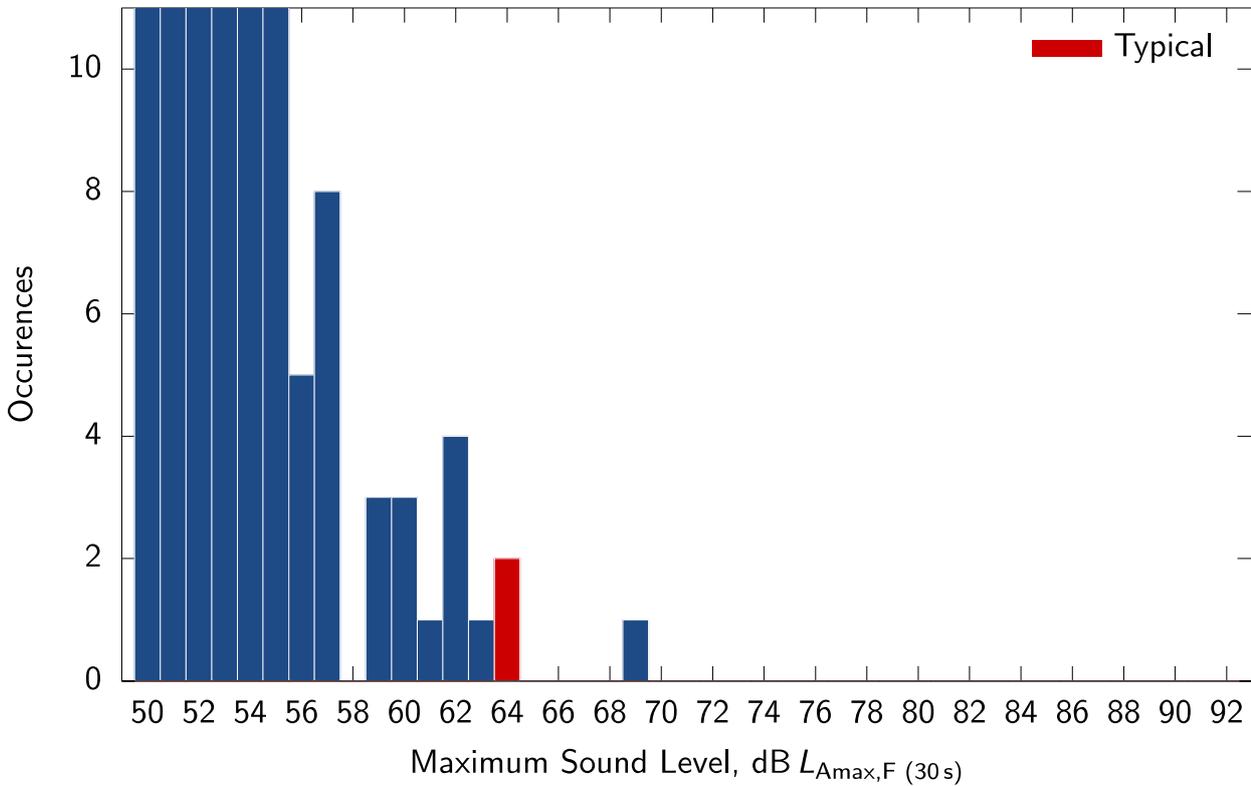
Evening events measured on Tuesday 11 October 2016 at Location 1



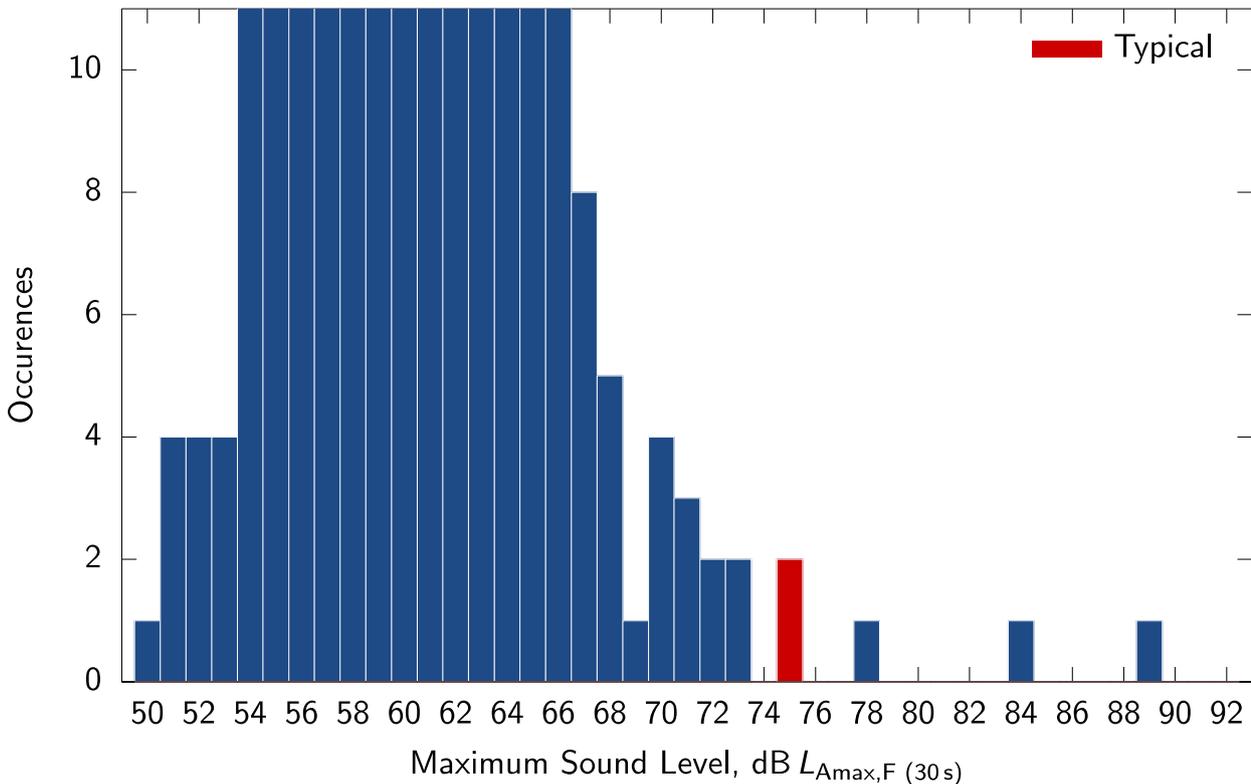
Evening events measured on Tuesday 11 October 2016 at Location 2



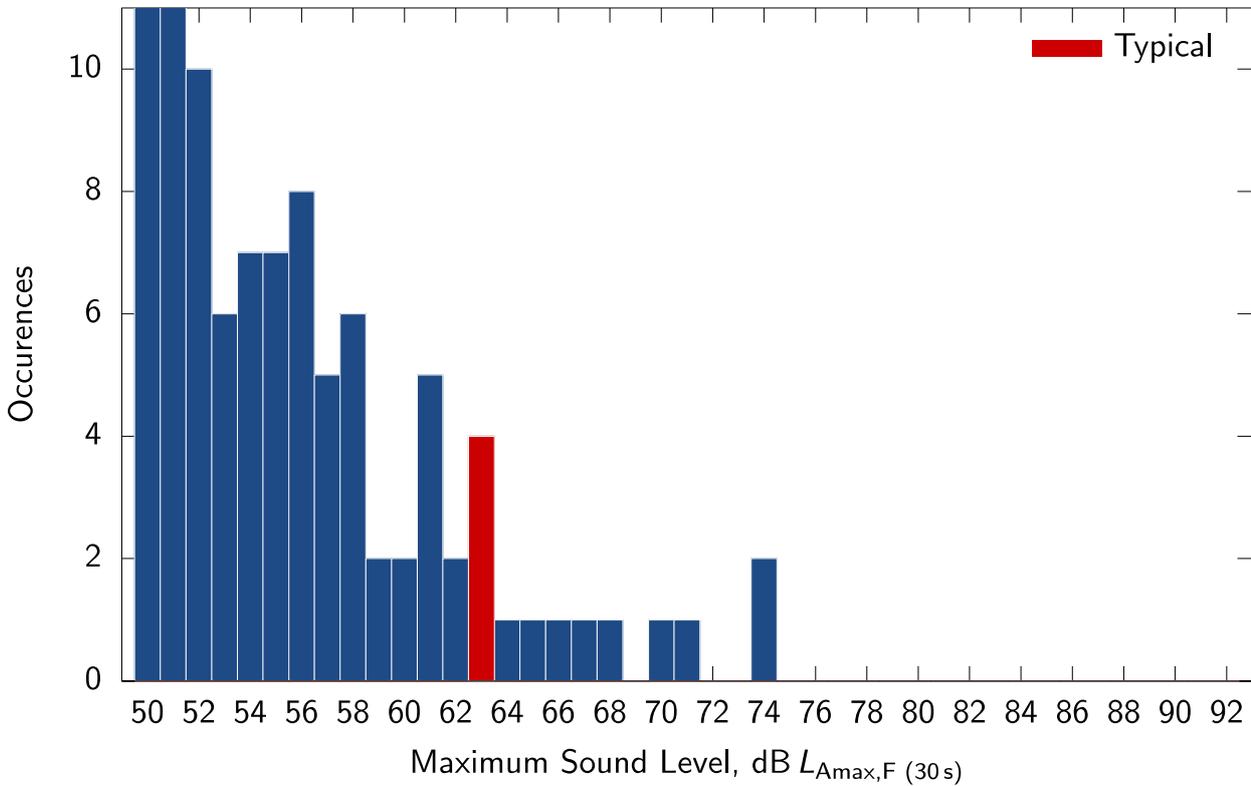
Evening events measured on Wednesday 12 October 2016 at Location 1



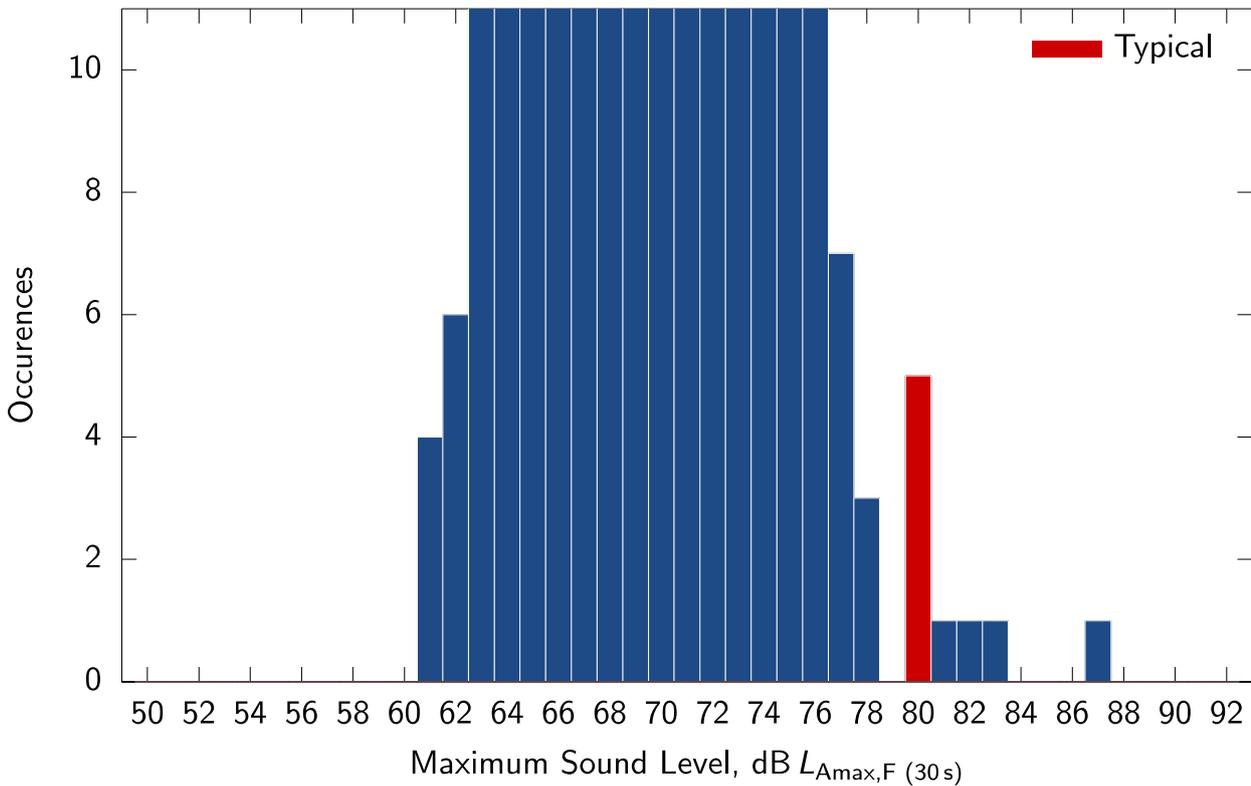
Evening events measured on Wednesday 12 October 2016 at Location 2



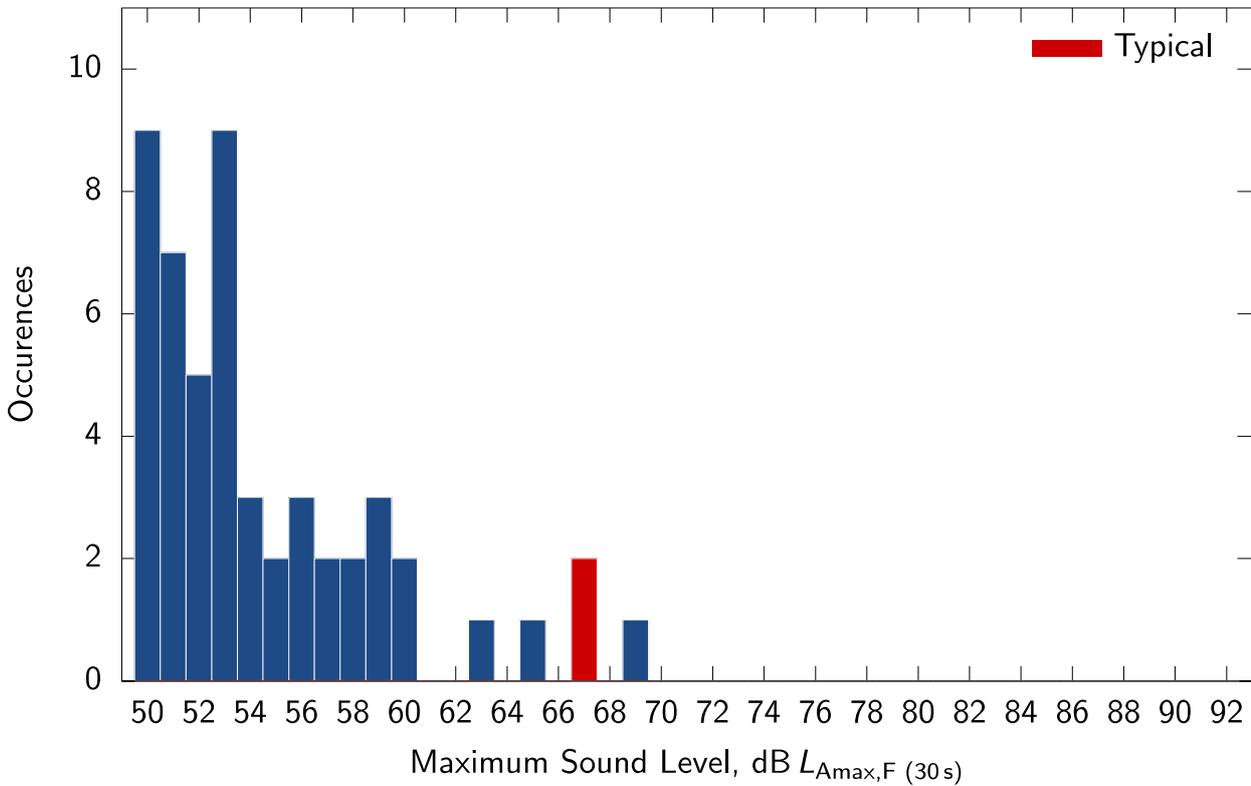
Evening events measured on Thursday 13 October 2016 at Location 1



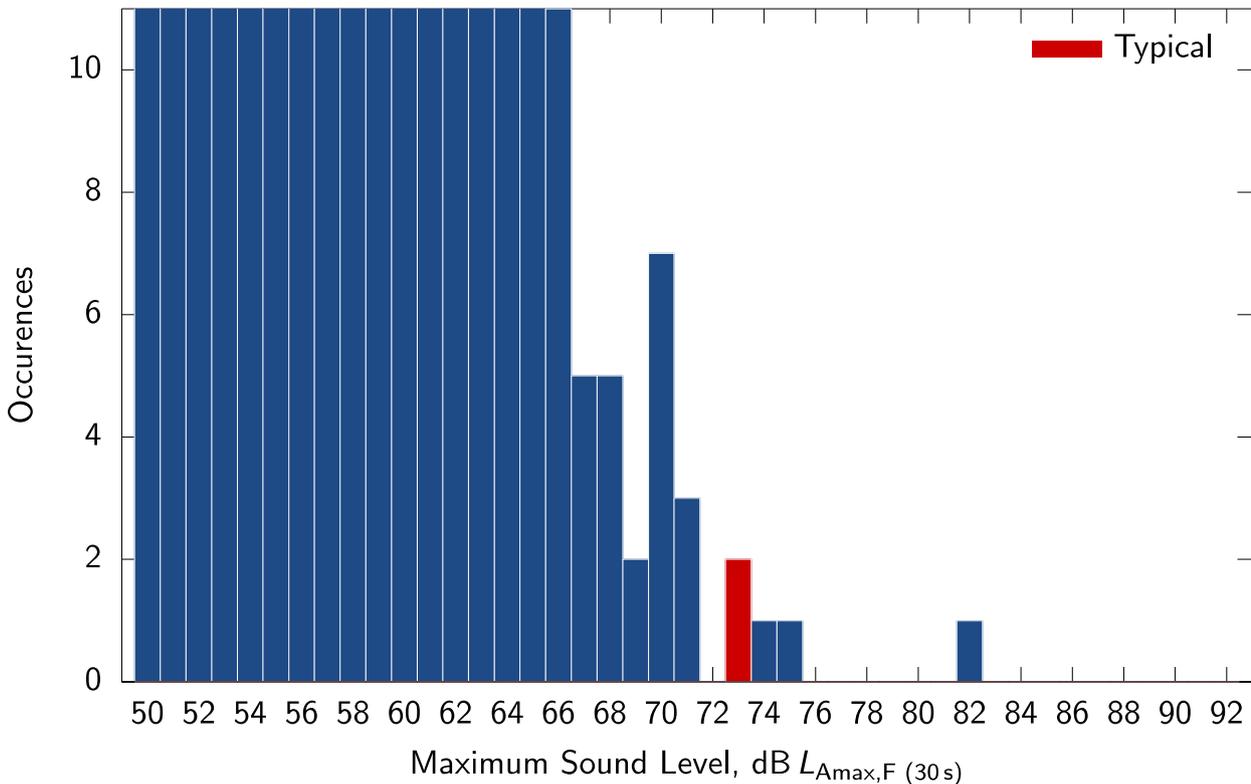
Evening events measured on Thursday 13 October 2016 at Location 2



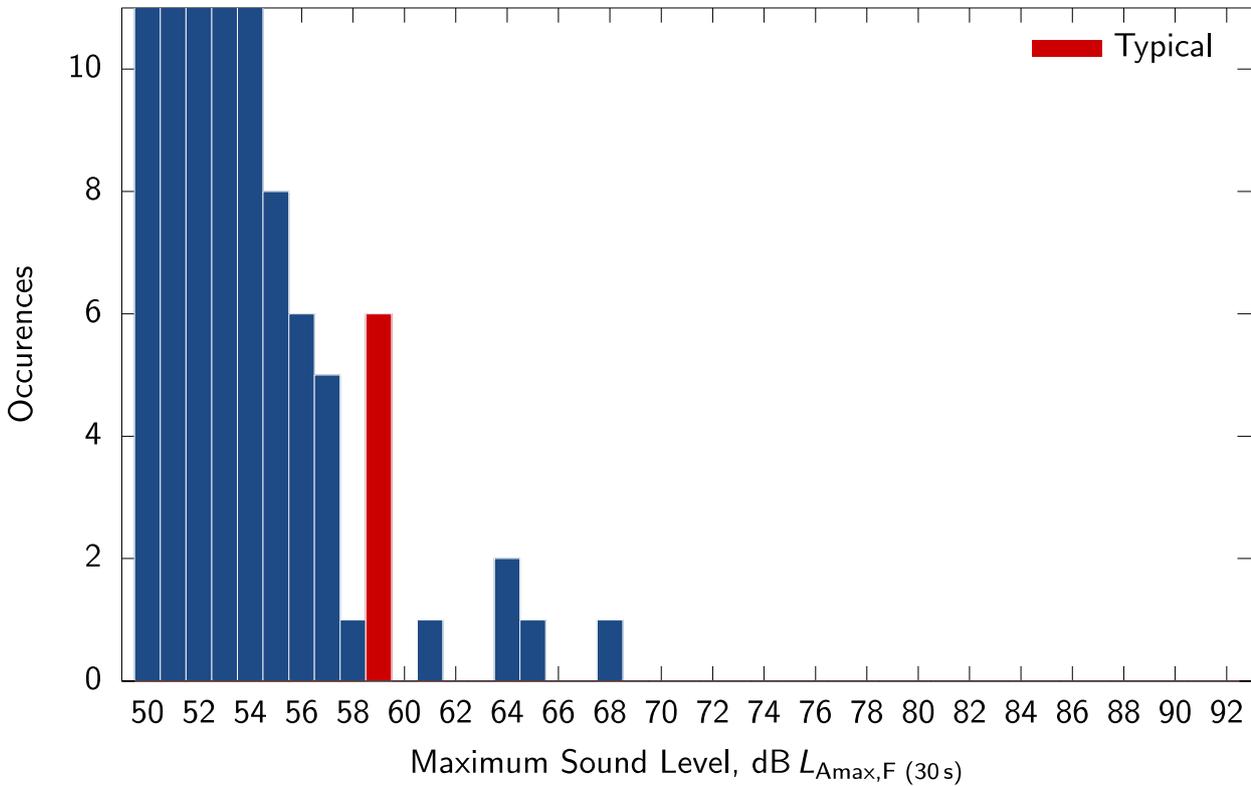
Night-time events measured on Tuesday 11 October 2016 at Location 1



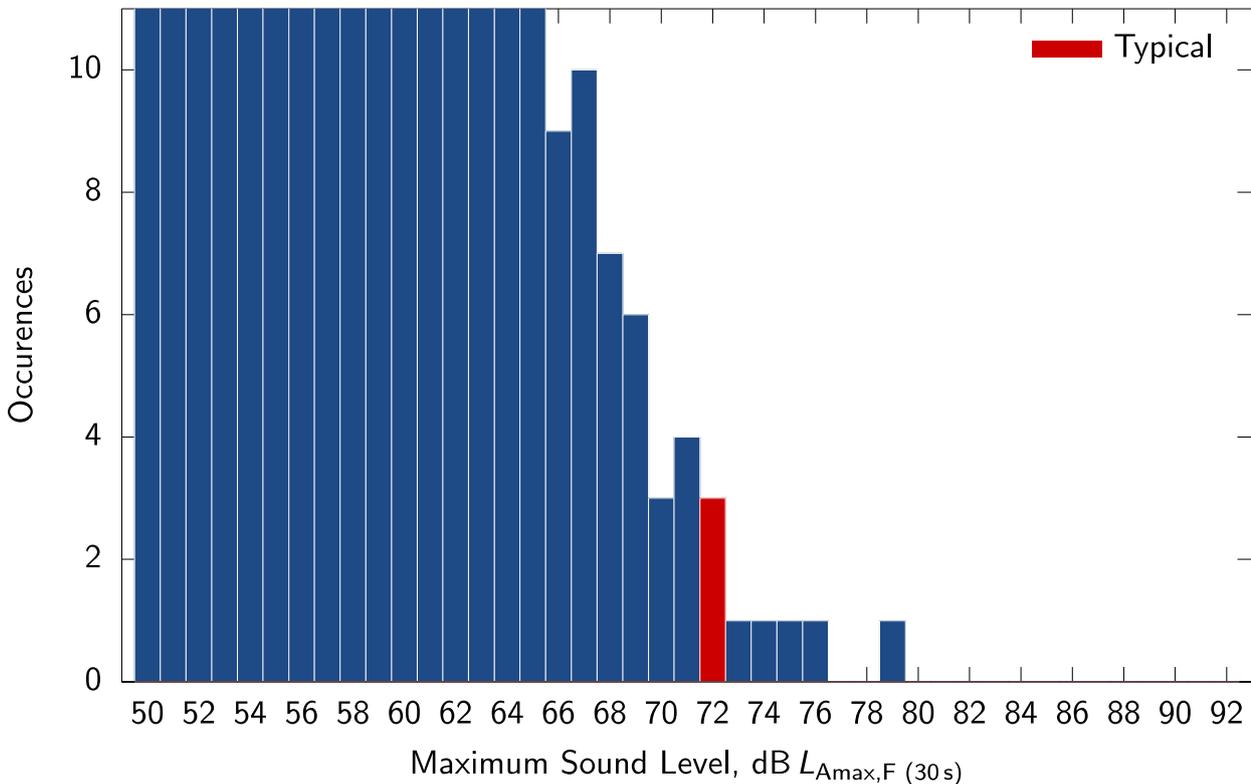
Night-time events measured on Tuesday 11 October 2016 at Location 2



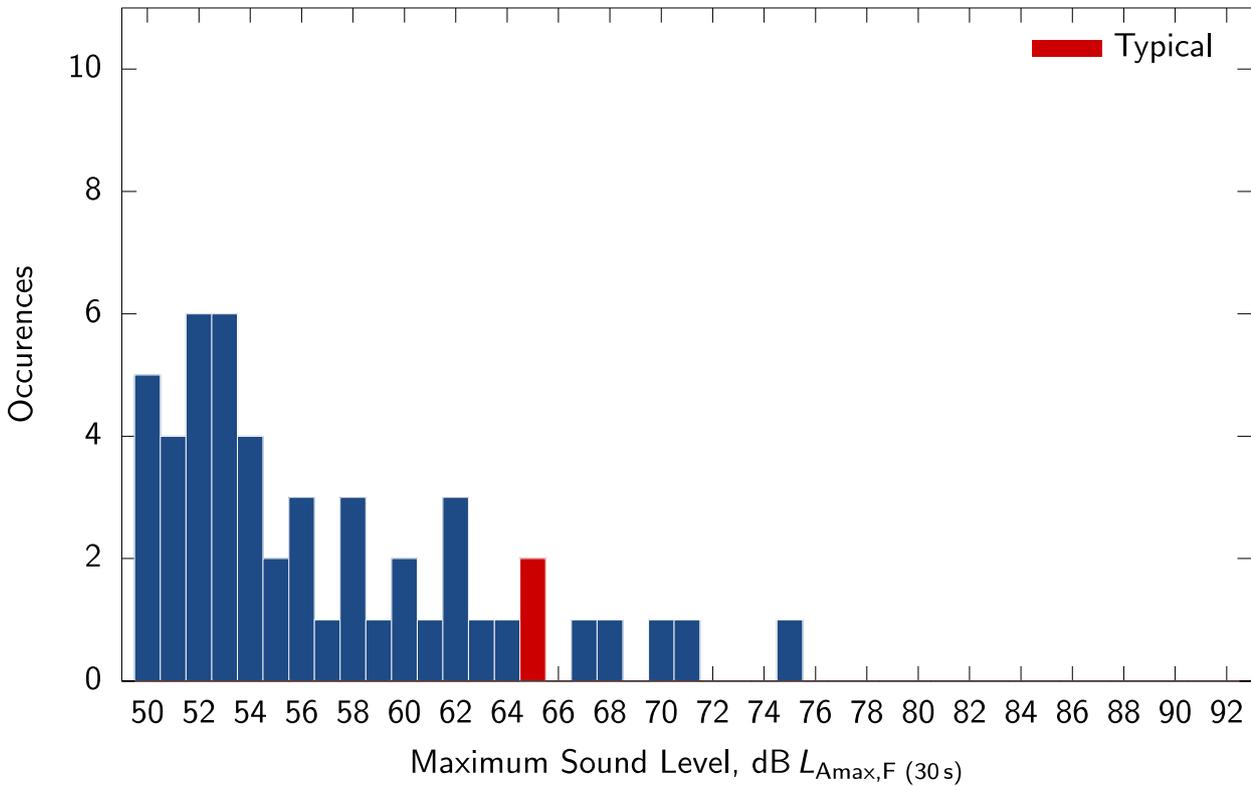
Night-time events measured on Wednesday 12 October 2016 at Location 1



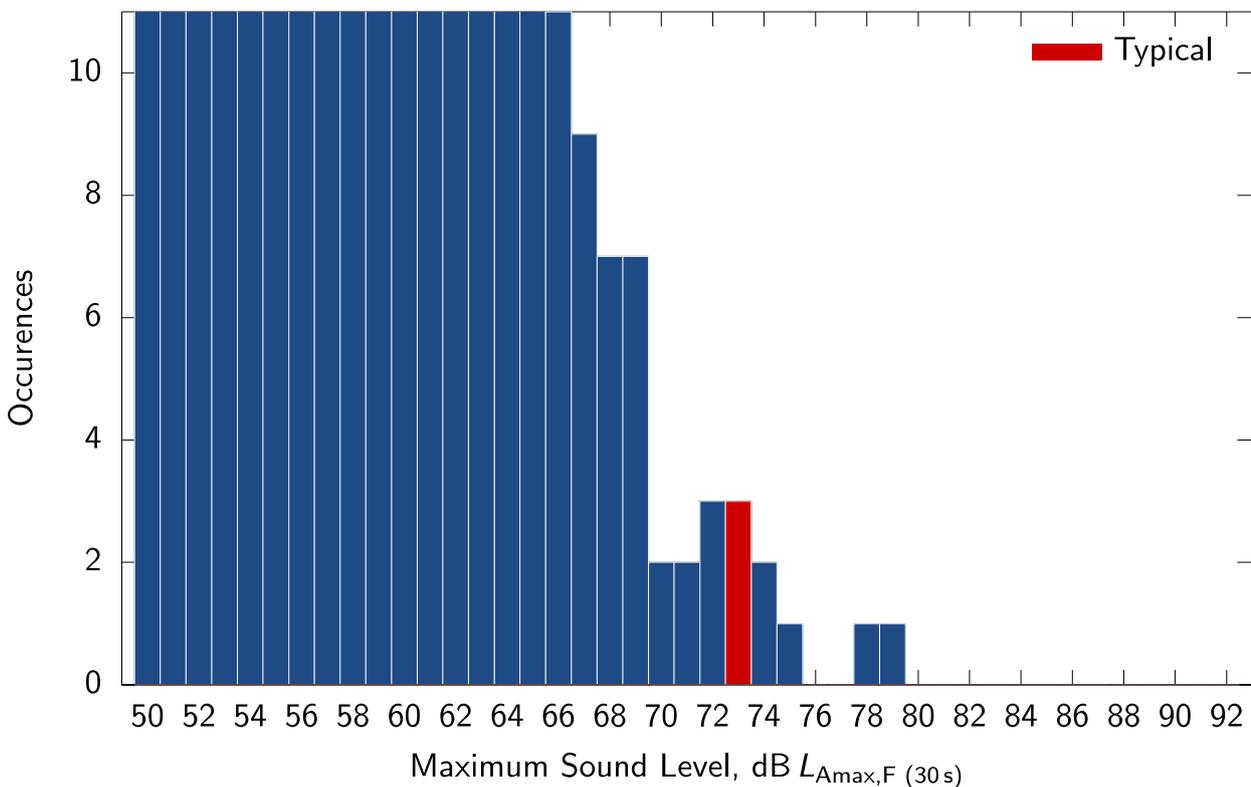
Night-time events measured on Wednesday 12 October 2016 at Location 2



Night-time events measured on Thursday 13 October 2016 at Location 1



Night-time events measured on Thursday 13 October 2016 at Location 2



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