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Airbus Broughton - Occupational Health & Wellbeing Centre

Acoustic Assessment

13 March 2019

Airbus, UK

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Contents

1 Introduction

Airbus UK, located in Broughton is applying for planning permission for a new Occupational Health & Wellbeing Centre for their employees. The proposed building will include occupational health, sports and social facilities.

The Site selected by Airbus UK to locate the new occupational health & wellbeing centre is adjacent to the main entrance to the South Site next to the Broughton FC Football Stadium and a disused grassed area close to the training pitches. The site is currently outside the Airbus UK Plant Security Line and not classed as Airside with regards Airfield Operations.

The site has been selected for a number of reasons not least its accessibility for Occupational Health Users. The operating times of the facility will be 24 hours a day due to the requirement for the occupational health to be open the same hours as the Airbus UK manufacturing facility.

The building will comprise an Occupational Health Suite with manned reception and secure access consultation and physiotherapy rooms and the more public Proactive Healthcare zone which will be a highly flexible area which can be configured to a number of uses including a gymnasium and conferencing/presentation space. A café and survey will also be provided. (Figure 1)

Car parking for the facility is anticipated to be limited to disabled spaces an emergency vehicle bay and 2-3 drop off bays.

The new facility, will be providing existing services currently offered by Airbus UK at other locations within the site.

The closest noise sensitive receptors to the site are residences on St Mary's Way to the south-west and residences on the corner of Broughton Hill Road and Chester Road to the south of the site. Figure 1 shows the site location and the closest noise sensitive receptors to the site.

Figure 1: Location, Extents and Closest Receptors to the Proposed Occupational Health & Wellbeing Centre

Source: © OpenStreetMap contributors, 2019[1]

[1] https://www.openstreetmap.org/copyright

2 Legislation Policy and Guidance

The following section provides details of the principal legislation, policy and guidance relevant to the proposed occupational health & wellbeing centre.

2.1 Legislation Policy And Guidance Framework

2.1.1 National Planning Policy

2.1.1.1 Well-Being Of Future Generations (Wales) Act[2], Welsh Government, 2015.

The Act has a number of well-being goals to achieve through implementing sustainable development. Changes in noise levels can have an impact on the health of habitat and humans, as such the goals to create 'a resilient Wales' and 'a healthier Wales' are applicable.

2.1.1.2 Planning Policy Wales Edition 9 - November 2016[3], Welsh Government, (2016).

Planning Policy Wales describes the planning development policies of the Welsh Assembly Government. Chapter 13 of the policy 'Minimising and Managing Environmental Risks and Pollution' sets out the policy objectives with regard to noise from new development. Paragraph 13.13.1 states the policy objectives:

'Noise can affect people's health and well-being and have a direct impact on wildlife and local amenity. Noise levels provide an indicator of local environmental quality. The objective of a policy for noise is to minimise emissions and reduce ambient noise levels to an acceptable standard. Noise Action Plans, drawn up by the Welsh Ministers in relation to Wales under the Environmental Noise Directive, and the Wales Regulations, aim to prevent and reduce environmental noise where necessary and preserve environmental noise quality where it is good. They are a planning consideration in the use and development of land.'

With regard to the assessment of noise associated with development, paragraph 13.15.1 states the following:

'Noise can be a material planning consideration, for example in proposals to use or develop land near an existing source of noise or where a proposed new development is likely to generate noise. Local planning authorities should make a careful assessment of likely noise levels and have regard to any relevant Noise Action Plan before determining such planning applications and in some circumstances, it will be necessary for a technical noise assessment to be provided by the developer.'

2.1.1.3 Technical Advice Note (TAN) 11: Noise[4], Welsh Government, (1997).

TAN 11 provides technical guidance on noise generating developments and "provides advice on the consideration of noise during the development plan". The note proposes appropriate

[2] Welsh Government, (2015). Well-being of Future Generations (Wales) Act 2015.
[3] Welsh Government, (2016). Planning Policy Wales Edition 9, November 2016.
[4] Welsh Government, (1997). Technical Advice Note (TAN) 11: Noise.

measurement indices for different types of source and receivers; discusses common planning conditions and details potential measures to mitigate noise.

2.1.2 Local Planning Policy

Flintshire County Council (FCC) adopted their Unitary Development Plan (FUDP) 2000-2015 in 2011, FCC, (2011)[5] Policy STR1 New Development, has the following statements applicable to the proposed development.

"New development will be:

a. generally located within existing settlement boundaries, allocations, development zones, principal employment areas and suitable brownfield sites and will only be permitted outside these areas where it is essential to have an open countryside location;
b. required to incorporate high standards of design which are appropriate to the building, site and locality, maximise the efficient use of resources, minimise the use of non-renewable resources and minimise the generation of waste and pollution;
c. required to create a safe, healthy and secure environment and protect standards of residential and other amenity;
f. required to minimise or negate pollution to air, water and land; and
g. assessed in terms of a precautionary approach whereby development proposals that would have a significant and uncertain environmental, social, economic or cultural impact, will be refused, in the absence of the best available information which proves that the impact can be negated or mitigated through proper risk control measures."

2.2 Guidance

2.2.1 WHO Guidelines For Community Noise 1999

The World Health Organization (WHO) "Guidelines for Community Noise", WHO, (1999)[6] are intended to guide the long-term management of community noise to help meet the WHO's core objective of "the attainment by all peoples of the highest possible levels of health". They set out various noise guide values for specific activities. These values represent the onset of specific effects such as annoyance or sleep disturbance.

For day-time noise levels WHO sets thresholds for annoyance for outdoor living areas for residences of $L_{Aeq,16hour}$ 50 dB for moderate annoyance and $L_{Aeq,16hour}$ 55 dB for serious annoyance.

2.2.2 WHO Night Noise Guidelines For Europe 2009

The WHO "Night Noise Guidelines for Europe", WHO, (2009)[7] suggested that there is insufficient evidence that the biological effects observed at the level below 40 $L_{night,outside}$ are harmful to health. The Guidelines suggest, on a precautionary basis, that the population should

[5] Flintshire County Council, 2011 URL available: https://www.flintshire.gov.uk/en/Resident/Planning/Development-plans--policies.aspx

[6] World Health Organisation, 1999 Guidelines for Community Noise [online] available at: http://www.who.int/docstore/peh/noise/guidelines2.html (last accessed November 2018).

[7] World Health Organisation, 2009. Night Noise Guidelines for Europe [online] available at: http://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf?ua=1 (last accessed November 2018).

not be exposed to a night noise guidelines (NNG) value greater than 40dB of $L_{night,outside}$ during the part of the night when most people are in bed. However, the precautionary nature of this target is fully appreciated by the WHO and an interim target of 55dB $L_{night,outside}$ is recommended in the situations where the achievement of NNG is not feasible in the short term.

2.2.3 WHO Environmental Noise Guidelines For the European Region

In October 2018, the World Health Organization (WHO) European Region published 'Environmental Noise Guidelines for the European Region', WHO, (2018)[8], as a regional update. The update has been made to account for the development of understanding and significant new evidence base on the health effects of noise and is founded on the findings of studies carried out between 1999 and 2015 to investigate the potential impact of noise on health. The new Guidelines also provide evidence-based recommendations which complement the expert-based recommendations of the WHO 'Night Noise Guidelines' (NNG).

The WHO 'Guidelines for Community Noise' provides the basis of the criteria used or referenced within standards, guidance and assessment methodologies underpinning government policy and guidance internationally. The new Guidelines "are intended to be suitable for policy-making in the WHO European Region". It will take time for the implications of the new Guidelines to be considered for application within Europe and UK.

The new guidelines provide source specific recommendations road traffic, railway, aircraft and wind turbine noise, and indoor as well as outdoor exposure levels for leisure noise.

2.2.4 British Standard 5228, (2009) Code of Practice For Noise And Vibration Control On Construction And Open Sites – Part 1: Noise

BS5228-1, BSI, (2009)[9] provides a methodology for predicting and assessing noise levels generated by fixed and mobile plant used for a range of typical construction operations. The standard includes a database of noise levels at a reference distance of 10m from the source and a simple noise propagation model that can be used to make allowance for effects such as source-receiver distances, ground properties and utilisation time.

2.2.5 British Standard 5228, (2009) Code Of Practice For Noise And Vibration Control On Construction And Open Sites – Part 2: Vibration

BS5228-2, BSI, (2009)[10], provides guidance on the effect of vibration and the likelihood it will cause complaint and cosmetic damage to buildings and gives recommendations for methods of vibration control. Vibration levels are predicted in terms of peak particle velocity (PPV).

2.3 British Standard 4142, (2014)[11] Methods For Rating And Assessing Industrial And Commercial Sound

BS4142, BSI, (2014), provides a means of assessing the likelihood of adverse impacts from the introduction of a new sound source to an area.

[8] World Health Organisation, 2018. Environmental Noise Guidelines for the European Region. ISBN 978 92 890 5356 3. URL available: http://www.euro.who.int/en/health-topics/environment-and-health/noise/publications/2018/environmental-noise-guidelines-for-the-european-region-2018 [Last accessed February 2019

[9] British Standards Institute, (2009) BS5228, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise

[9] British Standards Institute, (2009) BS5228, Code of practice for2009) noise and vibration control on construction and open sites – Part 2: Vibration.

[11] British Standards Institute, (2014) BS4142 Methods for rating and assessing industrial and commercial sound.

The level of sound from proposed new plant, the 'rating level' $L_{Ar,T}$, is predicted in terms of $L_{Aeq,T}$, and compared to the existing background sound level, expressed in terms of $L_{A90,T}$. If the new source is impulsive, intermittent or tonal in nature, then the 'rating level' includes a penalty, to account for the character of the sound.

The following conclusions may be drawn based upon the difference between the rating level and background sound level:

- *"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."*

2.3.1 British Standard 8233, (2014)[12] Guidance On Sound Insulation And Noise Reduction For Buildings

BS8233, BSI, (2014), offers guidance on indoor and outdoor ambient noise levels, based upon advice from the World Health Organisation Guidelines for Community Noise. BS8233 indoor noise criteria are reproduced in Table 1

Table 1: BS8233 Indoor Ambient Noise Criteria Relevant To The Proposed Occupational Health Building

Activity	Location	Design Range dB $L_{Aeq,T}$
Reasonable speech or telephone communications	Corridor, circulation space	45-55
Study and work requiring concentration	Staff/meeting/training room	35-45
Listening	Counselling, meditation, relation	30-35

Source: BS8233:2014 Table 6

2.3.2 Health Technical Memorandum 08-01: Acoustics

HTM-08-01, DofH, (2013)[13], sets out appropriate acoustic and vibration design criteria for health and social care facilities. These include criteria for internal ambient noise levels (Table 2) within hospital accommodation of various types due to break-in of noise from external sources (Table 3) which may include noise generated by existing facilities on site which are retained during the development. Evaluation of measured external noise levels will dictate building envelope design and ventilation strategy.

[12] British Standards Institute, (2014) BS8233 Guidance on sound insulation and noise reduction for buildings.

[13] Department of Health, (2013) Health Technical Memorandum 08-01: Acoustics

Table 2: HTM08-01 Criteria for Noise Intrusion from External Sources

Room Type	Example	Criteria For Noise Intrusion To Be Met Inside The Spaces From External Sources (dB)
Small office type spaces	Treatment rooms, consulting rooms	$40L_{Aeq,1hr}$
Large meeting rooms (>35m2 floor area)	Meeting rooms	$35L_{Aeq,1hr}$

Source: HTM-08-01 Excerpt from Table 1

Table 3: HTM08-01 Criteria For Noise Intrusion From Internal Sources

Room Type	Example	Criteria For Noise From Mechanical and Electrical Services
Small office type spaces	Private offices, treatment rooms, consulting rooms	NR35

Source: HTM-08-01 Excerpt from Table 2

3 Noise Survey

Measurement positions were selected based on a desktop review of the site and the location of the proposed new building. The review indicated that the anticipated main noise source for the site was road traffic noise from Chester Road (A5104). Additional potential noise sources included noise from the adjacent Hawarden Runway, St Mary's Church, (the bells of which chime for an extended period hourly), Airbus UK manufacturing facility, outdoor amenity spaces (pitches) within the Airbus boundary and local access roads.

Both short term attended noise measurements and an unattended long term (24hour) noise survey were undertaken during the period 09:11 on 5th February 2019 to 15:50 on 6th February 2019, to determine noise levels impinging on the site.

All measurements were undertaken by consultants competent in environmental noise monitoring and completed in accordance with the principles of BS 7445:2003 Description and Measurement of Environmental Noise BSI, (2003)[14]. All acoustic measurement equipment used during the noise survey was designed to be in conformance with BS EN 61672-2:2013[15] Electroacoustics. Sound Level Meters: Specifications BSI, (2013) to the requirements of the Class 1 standard.

All meters and field calibrators used held current calibration certificates obtained under laboratory conditions traceable to UK and International Standards. Before and after the measurement session the reference calibration level of the sound level meter was checked using a field calibrator.

At each position the microphone was supported using a tripod and was fitted with a windshield suitable for outdoor use. The sound level meters were positioned at ground floor level with the microphone at a height of 1.5m above local ground level. All measurements were free field unless otherwise stated.

A full inventory of this equipment is shown in Table 4.

Table 4: Inventory of Noise Measurement Equipment

Item	Make & Model	Serial Number	Calibration Due
Calibrator	Larson Davis CAL 200	2832	03/07/2019
Sound level meter	Rion NL 52	01143539	26/04/2019

3.1 Measurement Locations

Attended short term noise measurements were carried out at 4 locations (refer to Figure 2) in and around the site (referenced ST1 – ST4). The locations selected were chosen to quantify the typical noise levels at potential receivers on and off site.

A long-term unattended noise measurement (24 hours) was located on the training pitch (MTP) on the western boundary of the site, to capture typical noise levels at receptors on St Mary's Way. The houses on St Mary's Way form the site boundary of Airbus UK to the south west. LT1 was considered representative of the rear elevations of residences along St Mary's Way

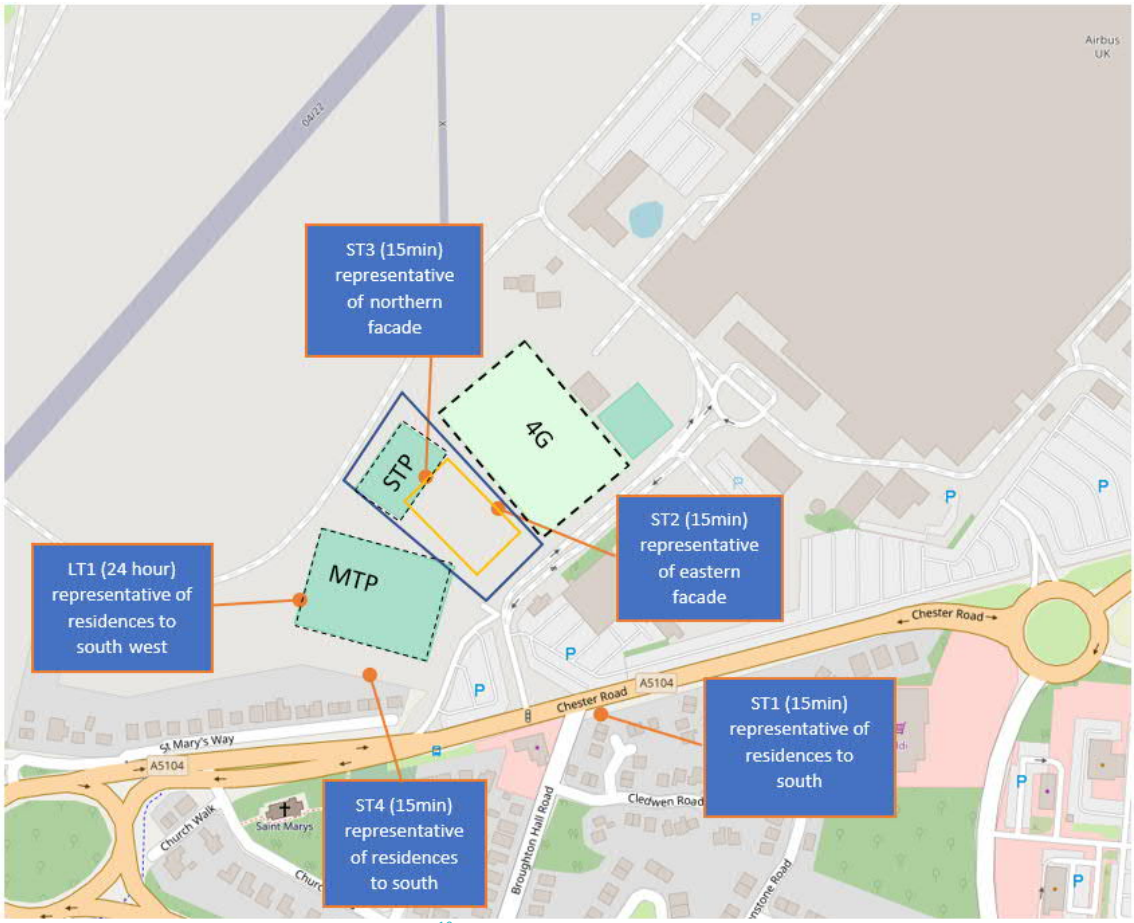
[14] British Standards Institute, (2003) BS7445 Description and Measurement of Environmental Noise.

[15] British Standards Institute BSEN 61672-2:2013 Electroacoustics. Sound Level Meters: Specifications.

and, having similar linear distance to Chester Road, the southern façade of the proposed facility.

All measurement locations are shown in Figure 2. Photographs of each measurement location are provided in Appendix A.

Figure 2: Noise Measurement Locations



Source: ©OpenStreetMap Contributors, 2019[16]

Table 5 provides a detailed description of the measurement locations.

Table 5 - Short Term Noise Measurement Locations

Location Reference	Description
ST1	Approximately 4m east of the intersection of Chester Road and Broughton Hill Road, on the grass patch 1m from the wooden boundary fence of the residences on Cadnant Court (façade corrected reading).
ST2	Approximately 12m south west of the southern end of the 4G pitch's stand (4G), on the proposed line of the eastern façade.
ST3	On the southern side of the small training pitch (STP) on the centre line (as marked).
ST4	3.5m from the Airbus perimeter fence, in line with the third house from the eastern end of St Mary's Way.

[16] https://www.openstreetmap.org/copyright

3.2 Measurement Conditions

The weather conditions during the survey period were dry with temperatures in the range 0°C - 9°C. Wind speeds were measured at <3m/s. Road conditions were dry throughout the measurement period. Cloud cover was between 40% and 95% during the attended measurements. The conditions were considered to be suitable for noise measurement.

3.3 Noise Measurement Results

Full details of the short-term noise measurements are provided in Table 6. All measurements inside the site boundary (ST2-4), were taken in free field. Location ST1 was a façade corrected measurement, this has been corrected to be free field by subtracting 3dB from the measured noise level. All measurements were taken for a 15minute period. A glossary of terms can be found in Appendix D.

Table 6: Summary Of Short-Term Measurements (dB) Taken 5th February 2019

Location And Reading Number	Measurement Start Time	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A10,15min}$	$L_{A90,15min}$
ST1-1	09:11	69	83	73	58
ST1-2	11:20	68	80	72	57
ST1-3	14:01	68	81	71	58
ST2-1	10:12	56	75	58	54
ST2-2	12:04	61	80	61	54
ST2-3	14:47	59	77	60	53
ST3-1	09:56	55	62	57	54
ST3-2	11:45	56	68	58	53
ST3-3	14:28	59	77	60	53
ST4-1	10:33	54	66	56	51
ST4-2	12:22	69	93	58	52
ST4-3	15:06	53	66	55	51

Details of the measured $L_{n,1\ hour}$ from the long-term noise measurement (LT1), are provided in Appendix B**.** The LT1, was positioned behind the ball nets located on the southern goal line of the main training pitch (MTP), (refer to Figure 2), the location was free field.

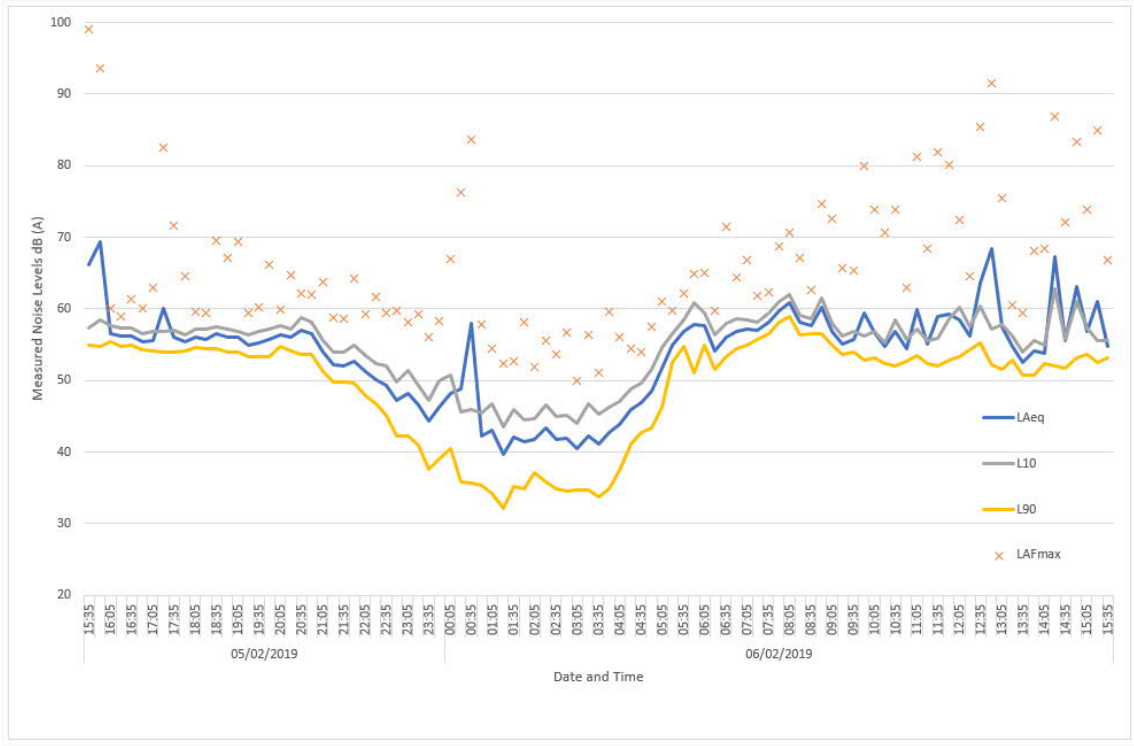
Table 7: Summary Of Long-Term (24 hour) Measurement (dB)

Start	Time	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A10,15min}$	$L_{A90,15min}$
05/02/2019	15:35	65	101	58	55
	16:35	57	83	57	54
	17:35	56	73	57	54
	18:35	56	70	57	54
	19:35	56	66	57	54
	20:35	55	64	57	52
	21:35	52	64	54	49
	22:35	48	60	51	43
	23:35	47	77	48	38
06/02/2019	00:35	52	85	45	34
	01:35	42	58	45	36
	02:35	42	57	45	35

Start	Time	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A10,15min}$	$L_{A90,15min}$
	03:35	44	60	47	37
	04:35	52	61	53	46
	05:35	57	65	59	53
	06:35	57	71	58	55
	07:35	59	71	60	58
	08:35	58	76	59	55
	09:35	57	80	56	53
	10:35	57	81	57	53
	11:35	58	82	58	53
	12:35	64	92	58	53
	13:35	62	87	57	52
	14:35	60	85	57	53

Figure 3: is a graphical presentation of the measured Ln,15minutes over the survey period 5-6th February 2019, from the long-term noise monitor LT1. Full details are presented in Appendix B.

Figure 3: Graph of Long-Term Measured Data



Ambient noise levels for the site south of the proposed development of 60dB $L_{Aeq,16hours}$ (Free field,0700-2300) daytime and 52dB $L_{Aeq,8hours}$ (Free field,2300-0700) night-time were derived from the measured noise levels at long-term measurement position LT1.

3.4 Observations

The existing noise climate at the site is dominated by road noise from Chester Road (A5104) with intermittent short duration inputs from Hawarden Airport Runway in the form of Beluga

movements and private light aircraft, St Mary's Church on St Mary's Way, onsite sports activities on the training and 3G pitches, (these were found to be in regular use throughout the survey period) and vehicles on the site access roads.

3.5 Uncertainty In Acoustic Measurements

Inevitably there is a degree of uncertainty in measured noise levels. Contributory factors to this uncertainty include tolerances in instrumentation readings, meteorological conditions and the inherent variation in the acoustic environment during the course of a day and indeed over longer periods as the noise sources influencing a given location vary. Any acoustic measurement is a snapshot of the noise climate at the time of the measurement. Every effort has been made to limit uncertainty in the measurements reported. Measures taken to limit uncertainty include:

- Undertaking surveys with appropriately qualified and trained acoustic engineers;
- Use of measurement equipment calibrated to appropriate standards by accredited bodies and checked on site using calibrated reference sound sources;
- Following best practice methodology for environmental noise measurement set out in BS7445;
- Measuring under appropriate meteorological conditions.

4 Assessment

This chapter presents an assessment of potential noise and vibration that may occur because of the construction and operation of the proposed Occupational Health & Wellbeing Centre at Airbus UK, Broughton. Planning consent will be sought from Flintshire County Council for the proposed facility.

The development has the potential to give rise to both temporary and permanent noise and vibration impacts that could affect nearby sensitive receptors adjacent to the west of the development and along the Chester Road. This report will explore these impacts and their potential effects, adverse or beneficial, at sensitive receptors.

4.1 Construction Noise and Vibration

At this stage in the design process details of construction methodologies and programme are not available. Quantitative predictions of construction noise levels have not therefore been carried out as part of this assessment.

The following is a qualitative discussion of control measures for potential noise and vibration which may arise during the construction period for the proposed development.

Noise and vibration from construction activities will usually be tolerated by the occupiers of sensitive receptors provided that prior notice is given, the effects are restricted to reasonable times and they are kept to a minimum. Limits for normal working hours and levels of noise at nearby properties will be agreed in advance with Flintshire County Council and incorporated into the specification for the proposed development.

Best Practicable Means for noise control (BPM) will be applied. BPM will be based upon guidance provided within BS5228 and should include the selection of the most appropriate method and plant for the job, adequate maintenance of plant, optimum siting of stationary plant, local screening and the education of the workforce. Restrictions may also be placed on early/late delivery times.

Good public relations are invaluable in securing public acceptance of construction noise. People are more tolerant of noise if they understand the reason for it, the likely duration, start and stop dates and that everything is being done to minimise noise levels. Letter box drops explaining this should be considered. A dedicated site contact for the public to request further information and complaints handling procedure to report disturbance should both be put in place at the start of, and maintained for the duration of, the works. Potentially affected residents will be kept informed in advance of the works and contacts details be provided to ensure residents can discuss any concerns with representatives of the construction team. Mitigation measures will help to reduce the significance of effects on nearby sensitive receptors.

Control measures related to construction noise and vibration will be set out within the main contractor's construction noise and vibration management plan for the project.

4.1.1 Noise Mitigation Measures

Mitigation measures will be employed to ensure that potential noise effects at nearby sensitive receptors due to construction activities are minimised. Noise mitigation measures may include the following:

- Selecting quieter construction equipment;
- Setting time restrictions on certain noisy activities;
- Ensure equipment is maintained, in good working order, and is used in accordance with the manufacturer's instructions;
- Members of the construction team should be trained and advised during tool box briefings on quiet working methods;
- Equipment should not be left running unnecessarily;
- Equipment should be fitted with silencers or mufflers;
- Use of plant enclosures utilised whenever feasible;
- Careful orientation of plant with directional feature away from sensitive receptors;
- Materials should be lowered instead of dropped from height;
- Inform nearby noise sensitive receptors in advance of construction activities and keep them up to date with progress and changes;
- Give nearby noise sensitive receptors a site contact telephone number; the contact should liaise with residents and maintain good rapport;
- Vehicles should not wait or queue up with engines running on the site or on the public highway;
- Manage deliveries to prevent queuing of site traffic at access points and the need for vehicles to reverse; and,
- Use of adjustable or directional audible vehicle-reversing alarms or use of alternative warning systems, e.g. white noise alarms.

4.1.2 Construction Vibration

Due to the distance between the nearest residential receiver and the site (min 105m), vibration from construction is not anticipated to be significant, however incorporated mitigation related to construction vibration would be set out within the construction noise and vibration management plan.

4.2 Noise From Operation Of The Proposed Facility To Offsite Noise Sensitive Receptors

4.2.1 Control Of Noise From Mechanical Plant Serving The Proposed Building

Typical day-time and night time background sound levels expressed as $L_{A90,1hour}$ which are representative of the nearest noise sensitive receptors have been determined from the unattended measurements presented in Table 7. These sound levels have been determined by modal analysis of the measured $L_{A90,15min}$ and are presented in Table 8.

Table 8: Typical Background Sound Levels Representative of Nearest Noise Sensitive Receptors.

Time Of Day	Typical Background Noise Level $L_{A90,T}$ (dB)
Day-time (07:00 – 23:00)	54
Night-time (23:00 – 07:00)	35

At this early stage the mechanical services plant that associated with the proposed building are not yet known but, may potentially include items such as: air handling units, pumps and extract fans, split system, condensers etc. The location of these items is also not currently known.

There is therefore some potential for noise from mechanical plant to impact upon nearby residential areas.

In the absence of guidance from the Local Authority, we propose that a limit for Rating Level as defined in BS4142, at the nearest noise sensitive receptors, is set at 10dB below the typical background sound level from Table 8.

A daytime limit for Rating Level for new fixed plant installations of 44 dB(A) at the nearest noise sensitive receptors is proposed.

A night-time for Rating Level for new fixed plant installations of 25 dB(A) at the nearest noise sensitive receptors is proposed.

If the plant contains tonal, intermittent, impulsive or other character features additional penalties are applied to the specific sound level to determine the rating level. This correction may be up to +18 dB, therefore the design should seek to avoid character features where reasonably practical. This will minimise the potential for adverse impact from noise emission from fixed plant at nearby noise sensitive receptors.

Standard methods of mitigation for mechanical items include but are not limited to:

- Locating mechanical noise sources (outlet, plant yards etc.), away from sensitive receivers.
- Selection of quiet versions of plant;
- Attenuators;
- Plant enclosures;
- Acoustic louvres;

These mitigation measures are commonly used on buildings of this type. The criteria given above are therefore readily achievable.

4.2.2 Site Activity Noise

The current activity noise levels experienced by the nearby residents to the west and south of the site are not anticipated to change. Airbus have confirmed that current usage of the training and 4G pitches is quite frequent, both by league teams (games at which spectators may be expected) and by youth and amateur teams related to the current social club. The pitches will be retained and as this is already part of the existing noise climate no additional noise from this source is anticipated.

The social section of the proposed building is intended to have a function room. Currently it is primarily intended for use as an internal function space for use by Airbus staff. This area has the potential to create noise which may affect nearby noise sensitive receivers. As such it is suggested that designers pay due care and attention to minimising the potential for noise break-out to noise sensitive receptors when designing the function space and the outdoor amenity area.

4.2.3 Traffic Considerations

Mott MacDonald have been advised that the proposed building is for use by Airbus UK employees. Traffic flows on local roads would need to increase by 25% above current levels to cause a perceptible noise increase, at potentially affected residents. No increase in traffic to the site is anticipated due to proposed facility and therefore no increase in noise due to increased traffic flows is predicted.

4.3 Current Noise Environment Potential Impacts On The Proposed Facility

Analysis of the measured noise levels shows the climate comprises contributions from several noise sources.

4.3.1 Traffic Noise Levels

Long term noise measurements indicate traffic noise is the dominant noise source for the site. The $L_{A10,18hour}$ was derived from the for the long term measured data collected for LT1, a resultant level of 56dB $L_{A10,\ 18hour}$ was calculated. This level may be mitigated through standard construction and typical thermal glazing.

4.3.2 Mechanical Noise

The current noise environment includes mechanical noise from the manufacturing facility. This noise was not clearly discernible as a separate discrete noise source during the attended measurements. However, during the quieter evening and night periods contributions may become more noticeable. It is suggested at a later stage once building layouts are available that a more detailed study of the impacts on each façade is made.

4.3.3 Aircraft Movements

The airfield noise was a mixture of loud (93dB $L_{Amax,15mins}$) noise events caused by take-off and landing of the specialist Beluga Aircraft and the less noisy but more frequent landing and take-off of private light aircraft.

4.3.3.1 Beluga Movements

These Beluga events were of very short duration (5-10 seconds), with approximately 2-3 Beluga movements over the course of the day. Given the limited frequency of these occurrences, it is proposed that the elevated noise levels caused by these events are not considered in the selection of the building envelope performance. Internal ambient noise level is likely to exceed the recommended levels during the Beluga events, however due to short duration it is unlikely to adversely impact building use.

4.3.3.2 Light Private Aircraft Movements

On average 3-5 light aircraft movements per hour were noted during the attended survey. The events are of short duration. The ambient the $L_{Aeq,T}$ levels reported above to inform the glazing and envelope specification include a sample of these events.

4.4 Implications Of External Ambient Noise Levels On Building Envelope and Ventilation Strategy

During the measurement period between the 5th and 6th February, the $L_{Aeq,15mins}$ readings were observed to vary between 54 and 61dB and between 47 and 57dB $L_{Aeq,15mins}$ during the night time period for typical measurements (refer section 4.3.3.1).

Table 9 summarises the primary noise source(s) impinging on each façade of the proposed building and the measured noise data considered typical of that façade. It should be noted that all measurements capture aircraft movements and road traffic noise as these sources are part of the makeup of the noise environment of the site.

Table 9: Typical Noise Levels At Impinging On Each Façade During The Daytime

Facade	$L_{Aeq,T}$ (dB)	Principal Noise Source Impacting On The Façade and Relevant Measurement Location
North	57	Runway, ST3
South	54*	Chester Road, ST4
East	61	4G Training Pitch, ST2
West	60	Chester Road and Runway, LT1

*Individual measurement ST4-2 (Table 6) was excluded from the calculation of typical noise level for this location as it included a Beluga movement, which has few occurrences daily and is considered atypical.

4.4.1 Glazing and Ventilation

It is understood that that the current proposal is for a mixed ventilation strategy with some rooms mechanically ventilated and others naturally ventilated with opening windows.

External noise levels incident on the various façades are detailed in Table 9. The internal ambient levels required range between 30-45dB $L_{Aeq,T,}$ depending upon room usage. There is a generally accepted assumption that slightly open windows achieve approximately 15dB noise reduction[17]. Therefore, external levels on the east and west facades and, in rooms with an internal ambient noise level requirement below 40dB $L_{Aeq,T}$ on the north and south facades, will be too high to allow for windows to be opened without internal ambient noise level criteria being exceeded. It is recommended that a mechanical exhaust system with an acoustically treated passive supply or mechanical ventilation strategy is employed for these spaces. If this approach is not considered acceptable, stakeholders will need to accept non-ideal internal ambient noise levels within some spaces.

Levels on the north and south facades impacting on rooms with internal ambient requirements of 40dB $L_{Aeq,T}$ or higher will potentially be able to utilise a natural ventilation strategy of open windows.

Where a mechanical ventilation strategy is applied, it will enable windows to be closed and appropriate internal ambient noise levels to be maintained. For typical building envelope constructions, the façade sound insulation is usually determined by the glazing and ventilation performance. An indicative calculation of external to internal noise break-in was performed using Marshall Day's Insul 2015© software; assuming as a worst case a fully glazed façade ($9m^2$), typical thermal double glazing (4-12-4) with a receiver room size of $40m^3$. External noise is predicted to be adequately mitigated to achieve the proposed internal noise criteria as detailed in Table 1, Table 2 and Table 3 with the use of a typical thermal glazed unit. We recommend that a more detailed analysis of noise break-in is undertaken once details of façade construction have been more clearly defined.

[17] World Health Organisation, 2009. Night Noise Guidelines for Europe [online] available at: http://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf?ua=1 (last accessed November 2018).

World Health Organisation, 2009. Night Noise Guidelines for Europe [online], Executive Summary, section XVIII, available at: http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf

4.4.2 WHO Criteria For Outdoor Amenity Areas At Nearby Residences And For Night-Time Noise Outside Residences.

The noise levels measured at the site indicate that noise levels currently exceed the WHO Guideline threshold for serious annoyance within outdoor living areas of residences, and that the precautionary night noise guideline of 40dB of $L_{night,outside}$ is also currently exceeded.

It is important, therefore to ensure that the operation of the proposed development does not further elevate noise levels at nearby noise sensitive receptors.

5 Conclusions

Mott MacDonald has undertaken a noise impact assessment in support of the planning application for a proposed Occupational Health & Wellbeing Centre at Airbus UK in Broughton.

Noise levels of 60dB $L_{Aeq,16hour}$ (daytime) and 52dB $L_{Aeq,8hour}$ (night time) were measured to the south of the proposed development site. Short term noise levels were found to vary with location and time. During the daytime period levels between 54 and 69dB $L_{Aeq,15min,}$ were measured, with variation between 40 and 57dB $L_{Aeq,15min}$ during the night time period.

A daytime limit for Rating Level for new fixed plant installations of 44 dB(A) at the nearest noise sensitive receptors is proposed.

A night-time limit for Rating Level for new fixed plant installations of 25 dB(A) at the nearest noise sensitive receptors is proposed.

It is understood that that the current proposal is for a mixed ventilation strategy with some rooms mechanically ventilated and others naturally ventilated with opening windows.

Levels on the north and south facades impacting on rooms with internal ambient requirements of 40dB $L_{Aeq,T}$ or higher will potentially be able to utilise a natural ventilation strategy of open windows for spaces.

The east and west facades and, where there are rooms with an internal ambient noise level requirement below 40dB $L_{Aeq,T,}$ on the north and south facades, will be too high to allow for windows to be opened without internal ambient noise level criteria being exceeded. It is recommended that a mechanical exhaust system with an acoustically treated passive supply or mechanical ventilation strategy is employed for these spaces. If this approach is not considered acceptable, stakeholders will need to accept non-ideal internal ambient noise levels within some spaces.

It is predicted where a mechanical ventilation strategy is applied, it will enable windows to be closed and appropriate internal ambient noise levels to be maintained. Satisfactory internal noise levels from external noise sources can be achieved in all spaces using typical thermal double glazing with windows closed, however more detailed predictions should be undertaken once façade constructions are confirmed.

WHO Guidelines for serious annoyance within outdoor living areas of nearby noise sensitive receptors have been considered, as well as night-time noise guidelines in the context of the measured noise levels and potential noise generating facilities at this facility. Guideline levels are already exceeded in the baseline noise climate. It is important, therefore to ensure that the operation of the proposed development does not further elevate noise levels at nearby noise sensitive receptors.

A. Photographs of Measurement Locations

Figure 4: ST1

Figure 5: ST2

Figure 6: ST3

No available image of equipment, image on left shows the view to the north from in front of the measurement position.

Figure 7: ST4

Figure 8: LT1

B. Measured Long-Term Data

Table 10: Measured $L_{n,15minute}$ Data From Unattended Noise Monitoring Location LT1

Date	Time	$L_{Aeq,15mins}$	$L_{AFmax,15mins}$	$L_{10,15mins}$	$L_{90,15mins}$
05/02/2019	15:35	66	99	57	55
	15:50	69	94	59	55
	16:05	57	60	58	55
	16:20	56	59	57	55
	16:35	56	61	57	55
	16:50	55	60	57	54
	17:05	56	63	57	54
	17:20	60	83	57	54
	17:35	56	72	57	54
	17:50	55	65	56	54
	18:05	56	60	57	55
	18:20	56	59	57	54
	18:35	57	70	58	54
	18:50	56	67	57	54
	19:05	56	69	57	54
	19:20	55	60	56	53
	19:35	55	60	57	53
	19:50	56	66	57	53
	20:05	56	60	58	55
	20:20	56	65	57	54
	20:35	57	62	59	54
	20:50	57	62	58	54
	21:05	54	64	56	51
	21:20	52	59	54	50
	21:35	52	59	54	50
	21:50	53	64	55	50
	22:05	51	59	54	48
	22:20	50	62	52	47
	22:35	49	60	52	45
	22:50	47	60	50	42
	23:05	48	58	51	42
	23:20	47	59	49	41
	23:35	44	56	47	38
	23:50	46	58	50	39
06/02/2019	00:05	48	67	51	41
	00:20	49	76	46	36
	00:35	58	84	46	36
	00:50	42	58	46	35
	01:05	43	54	47	34
	01:20	40	52	44	32
	01:35	42	53	46	35

Date	Time	$L_{Aeq,15mins}$	$L_{AFmax,15mins}$	$L_{10,15mins}$	$L_{90,15mins}$
	01:50	41	58	45	35
	02:05	42	52	45	37
	02:20	43	56	47	36
	02:35	42	54	45	35
	02:50	42	57	45	35
	03:05	41	50	44	35
	03:20	42	56	47	35
	03:35	41	51	45	34
	03:50	43	60	46	35
	04:05	44	56	47	37
	04:20	46	54	49	41
	04:35	47	54	50	43
	04:50	49	58	52	43
	05:05	52	61	55	46
	05:20	55	60	57	53
	05:35	57	62	58	55
	05:50	58	65	61	51
	06:05	58	65	59	55
	06:20	54	60	56	52
	06:35	56	71	58	53
	06:50	57	64	59	55
	07:05	57	67	59	55
	07:20	57	62	58	56
	07:35	58	62	59	57
	07:50	60	69	61	58
	08:05	61	71	62	59
	08:20	58	67	59	56
	08:35	58	63	59	57
	08:50	60	75	62	57
	09:05	57	73	58	55
	09:20	55	66	56	54
	09:35	56	65	57	54
	09:50	60	80	56	53
	10:05	57	74	57	53
	10:20	55	71	55	52
	10:35	57	74	59	52
	10:50	54	63	56	53
	11:05	60	81	57	54
	11:20	55	68	56	52
	11:35	59	82	56	52
	11:50	59	80	59	53
	12:05	59	72	60	53
	12:20	56	65	58	54
	12:35	64	86	60	55
	12:50	68	92	57	52
	13:05	58	76	58	52
	13:20	55	61	56	53

Date	Time	$L_{Aeq,15mins}$	$L_{AFmax,15mins}$	$L_{10,15mins}$	$L_{90,15mins}$
	13:35	53	59	54	51
	13:50	54	68	56	51
	14:05	54	68	55	52
	14:20	67	87	63	52
	14:35	56	72	56	52
	14:50	63	83	61	53
	15:05	57	74	57	54
	15:20	61	85	56	53
	15:35	55	67	56	53

C. Meteorological Data

Table 11: Meteorological Data For The Measurement Period

Date	Time	Rainfall Accumulation	Wind Speed	Air Temperature
06/02/2019	15:57	0	1	10
06/02/2019	15:42	0	1	10
06/02/2019	15:27	0	1	10
06/02/2019	15:12	0	1	10
06/02/2019	14:57	0	1	10
06/02/2019	14:42	0	0	11
06/02/2019	14:27	0	1	11
06/02/2019	14:12	0	0	10
06/02/2019	13:57	0	1	11
06/02/2019	13:42	0	0	11
06/02/2019	13:27	0	2	9
06/02/2019	13:12	0	1	10
06/02/2019	12:57	0	2	9
06/02/2019	12:42	0	3	8
06/02/2019	12:27	0	1	8
06/02/2019	12:12	0	1	8
06/02/2019	11:57	0	1	8
06/02/2019	11:42	0	0	8
06/02/2019	11:27	0	0	7
06/02/2019	11:12	0	1	7
06/02/2019	10:57	0	1	7
06/02/2019	10:42	0	1	7
06/02/2019	10:27	0	1	7
06/02/2019	10:12	0	1	7
06/02/2019	09:57	0	0	7
06/02/2019	09:42	0	0	6
06/02/2019	09:27	0	0	6
06/02/2019	09:12	0	1	6
06/02/2019	08:57	0	1	6
06/02/2019	08:42	0	1	6
06/02/2019	08:27	0	1	6
06/02/2019	08:12	0	1	5
06/02/2019	07:57	0	1	5
06/02/2019	07:42	0	1	4
06/02/2019	07:27	0	0	2
06/02/2019	07:12	0	0	3
06/02/2019	06:57	0	0	4
06/02/2019	06:42	0	0	3
06/02/2019	06:27	0	0	3
06/02/2019	06:12	0	0	3
06/02/2019	05:57	0	0	3

Date	Time	Rainfall Accumulation	Wind Speed	Air Temperature
06/02/2019	05:42	0	0	4
06/02/2019	05:27	0	0	4
06/02/2019	05:12	0	0	4
06/02/2019	04:57	0	0	4
06/02/2019	04:42	0	0	5
06/02/2019	04:27	0	0	5
06/02/2019	04:12	0	0	5
06/02/2019	03:57	0	0	6
06/02/2019	03:42	0	0	6
06/02/2019	03:27	0	0	6
06/02/2019	03:12	0	0	6
06/02/2019	02:57	0	0	6
06/02/2019	02:42	0	0	7
06/02/2019	02:27	0	1	7
06/02/2019	02:12	0	0	7
06/02/2019	01:57	0	0	8
06/02/2019	01:42	0	0	8
06/02/2019	01:27	0	0	9
06/02/2019	01:12	0	1	9
06/02/2019	00:57	0	2	9
06/02/2019	00:42	0	1	9
06/02/2019	00:27	0	0	9
06/02/2019	00:12	0	0	9
05/02/2019	23:57	1	1	9
05/02/2019	23:42	1	0	9
05/02/2019	23:27	1	0	9
05/02/2019	23:12	1	0	9
05/02/2019	22:57	1	0	9
05/02/2019	22:42	1	0	9
05/02/2019	22:27	1	0	9
05/02/2019	22:12	1	1	9
05/02/2019	21:57	1	0	9
05/02/2019	21:42	1	1	8
05/02/2019	21:27	1	1	8
05/02/2019	21:12	1	1	8
05/02/2019	20:57	1	2	8
05/02/2019	20:42	1	1	8
05/02/2019	20:32	1	1	8
05/02/2019	20:17	1	1	8
05/02/2019	20:02	1	2	8
05/02/2019	19:47	1	1	8
05/02/2019	19:32	0	2	8
05/02/2019	19:17	0	2	8
05/02/2019	19:02	0	2	8
05/02/2019	18:47	0	3	8
05/02/2019	18:32	0	2	8

Date	Time	Rainfall Accumulation	Wind Speed	Air Temperature
05/02/2019	18:17	0	1	8
05/02/2019	18:02	0	2	8
05/02/2019	17:47	0	0	8
05/02/2019	17:32	0	1	8
05/02/2019	17:17	0	2	8
05/02/2019	17:02	0	0	8
05/02/2019	16:47	0	1	8
05/02/2019	16:32	0	0	8
05/02/2019	16:17	0	1	7
05/02/2019	16:02	0	1	7
05/02/2019	15:47	0	1	7
05/02/2019	15:32	0	0	7
05/02/2019	15:17	0	1	7
05/02/2019	15:02	0	1	7
05/02/2019	14:47	0	1	7
05/02/2019	14:32	0	2	7
05/02/2019	14:17	0	2	7
05/02/2019	14:02	0	1	6
05/02/2019	13:47	0	1	6
05/02/2019	13:32	0	1	6
05/02/2019	13:17	0	1	6
05/02/2019	13:02	0	2	6
05/02/2019	12:47	0	1	6
05/02/2019	12:32	0	2	6
05/02/2019	12:17	0	1	6
05/02/2019	12:02	0	1	5
05/02/2019	11:47	0	2	5
05/02/2019	11:32	0	2	4
05/02/2019	11:17	0	1	3
05/02/2019	11:02	0	1	3
05/02/2019	10:47	0	1	2
05/02/2019	10:32	0	0	2
05/02/2019	10:17	0	1	2
05/02/2019	10:02	0	2	2
05/02/2019	09:47	0	1	0
05/02/2019	09:32	0	1	1
05/02/2019	09:17	0	1	1
05/02/2019	09:02	0	0	0

Source: Met Office, 2019 https://wow.metoffice.gov.uk Broughton (890196001)

D. Glossary

A-weighting	The human ear also has a non-linear frequency response, being most sensitive in the frequency range 1 kHz to 4 kHz and is less sensitive at higher and lower frequencies. The A-weighting is a frequency function commonly applied to the linear output of a microphone to simulate the subjective response of the ear. A-weighted levels are usually indicated by a subscript A or postscript (A).
Ambient noise	This is the total sound for a given scenario where the acoustic field is affected by a variety of sources.
Decibel	Sound and noise are commonly described using the decibel (dB) scale, which is logarithmic in nature to relate to the response of the human ear. The range of human hearing commonly varies from the threshold of audibility (0 dB) to the threshold of pain (120 dB). Such limits are seldom experienced in practice and typical levels might vary between 30 dB in a quiet bedroom at night to 90 dB at the kerbside of a busy road.
Equivalent continuous noise level L_{eq}	Time-varying noise such as that from industrial or construction operations may not best be described using the statistical approach described above. The equivalent continuous noise level, $L_{Aeq,T}$, may be used, which is the notional level of a steady sound which, at a given position and over the same period of time (T), would deliver the same sound energy as the fluctuating one.
Façade sound level	The received sound level which is measured or calculated immediately adjacent to a building façade, normally at 1m distance. Sound is reflected by the hard surfaces of a façade producing a slightly higher sound level (2.5 to 3.0 dB) than would occur in the absence of the building.
Free field sound level	The sound level which is measured or calculated within an acoustic field which is free of significantly reflective surfaces (except the ground plane).
Maximum sound pressure level $L_{(max)}$	The highest A-weighted sound level reached within the measurement period. “Fast” denotes that the level is weighted to the response time of the ear (125 ms) instead of to 1 second (denoted “Slow”).
Statistical noise level L_N	Noise which fluctuates with time may be described using a statistical approach. The statistical level LAN is the level in dB exceeded for N % of the overall measurement period. L_{A90} is the noise level exceeded for 90 % of the sampling period and is a measure the lower levels in the absence of higher level transient events. It is commonly used to describe the ambient or background noise. The L_{A10} is the noise level exceeded for 10 % of the sampling period and is a measure the higher levels. In the UK, it is commonly used to describe road traffic noise and, when considered over the 18-hour period 06:00 to 24:00 is referred to as the traffic noise index.
Rating noise level	Noise level of an industrial noise source with any appropriate corrections applied for the presence of distinct acoustic features.

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