HOARE LEA

TK Maxx Reading Oracle. Reading.
TJX Europe.

ACOUSTICS
NOISE IMPACT ASSESSMENT

REVISION 01 – 06 FEBRUARY 2025

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
01	06/02/2025	For issue.	TH	BRD	BRD

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Project number: 10/15947
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Executive summary

Hoare Lea has conducted a noise impact assessment of building services plant serving the proposed TK Maxx Store at The Oracle Shopping Centre in Reading.

The following summarises the assessment procedure and findings contained within this report:

- In accordance with the Local Authority's comments, reference is made to background noise levels measured by Hoare Lea in September 2019 and used to define building services plant at the nearest noise sensitive receptors.
- The nearest noise sensitive receptors have been identified as existing residential dwellings within Riverside House to the west of the proposed store.
- It is understood that the store opening hours are 0930 to 2000 Monday to Friday, 0900 to 1900 on Saturdays and 1100 to 1700 on Sundays and that the proposed building services plant will operate for a maximum of an hour before the store opens and after the store closes (0830 to 2100 Monday to Friday, 0800 to 2000 on Saturdays and 1000 to 1800 on Sundays).
- During the time in which the plant will be operational, the combined building services plant noise emission contribution limit advised is 43 dB(A), one metre from the nearest noise sensitive residential receptor.
- An assessment of noise associated with the proposed items of building services plant has been undertaken. The predicted noise level achieves the defined noise emission limit at the residential receptors during the daytime without any requirement for further mitigation measures.

1. Introduction.

Hoare Lea Acoustics has been appointed by TJX Europe to conduct a noise impact assessment for the installation of nine air conditioning units and an air handling units as part of the proposed TK Maxx Store at The Oracle Shopping Centre in Reading.

This report provides an assessment indicating how the new mechanical services plant associated with the development will comply with the Local Authority's criteria.

To aid in the understanding of the assessment, definitions of technical terms used have been included in Appendix A.

2. Site description.

2.1 Existing site.

The proposed TK Maxx Store is the former House of Fraser store located within The Oracle Shopping Centre in Reading. The site is bound by Bridge Street to the west.

The surrounding buildings are mixed in nature with residential dwellings located immediately opposite the proposed store within 1-48 Riverside House on Fobney Street, as well as Reading Civic Centre and Reading Borough Council's offices.

It is understood that the store opening hours are 0930 to 2000 Monday to Friday, 0900 to 1900 on Saturdays and 1100 to 1700 on Sundays and that the proposed building services plant will operate for a maximum of an hour before the store opens and after the store closes (0830 to 2100 Monday to Friday, 0800 to 2000 on Saturdays and 1000 to 1800 on Sundays).

The proposed development site (indicative only) including the nearest noise sensitive receptors is identified in Figures 1 and 2 below.

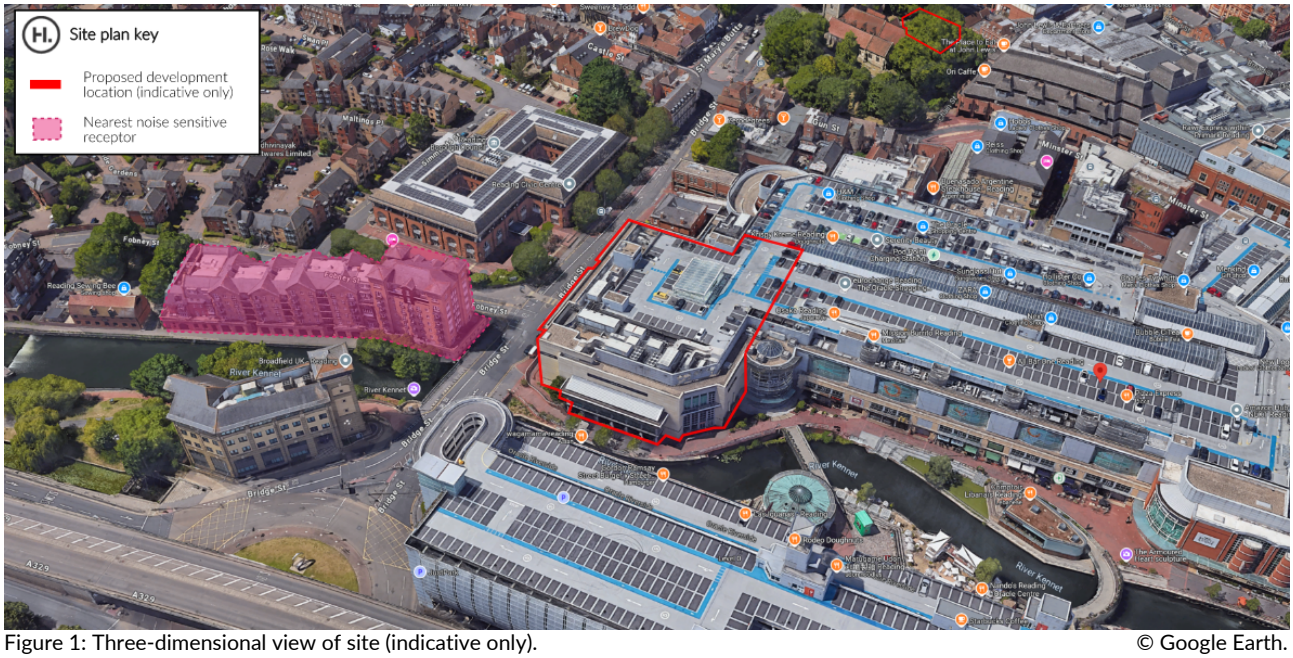


Figure 1: Three-dimensional view of site (indicative only). © Google Earth.

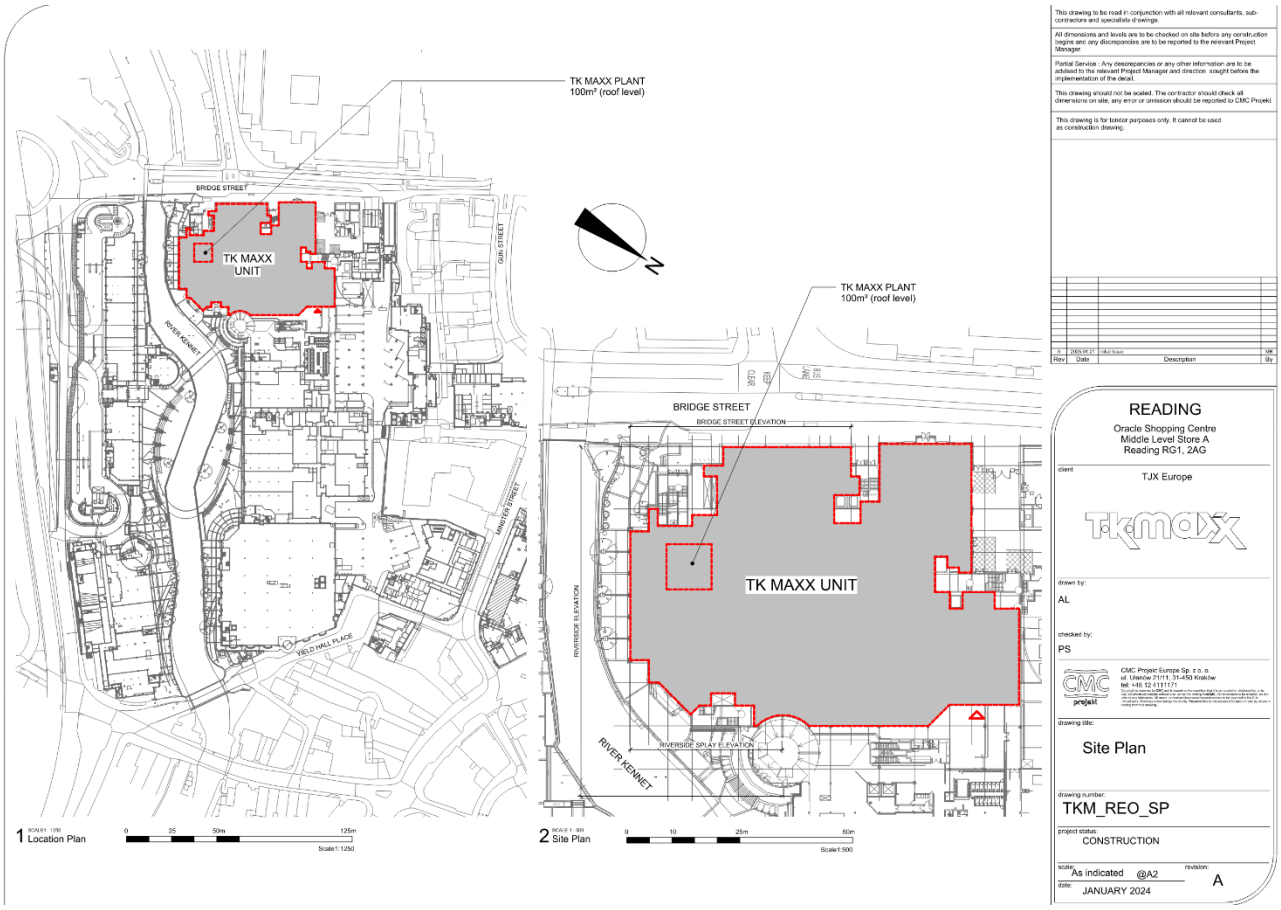


Figure 2: Proposed TK Maxx Store location.

3. Basis of assessment.

3.1 National planning policy framework (NPPF): 2024.

The revised National Planning Policy Framework (1) published in December 2024 sets out the Government's current planning policies for England and how these are expected to be applied. The NPPF supersedes the previous NPPF published in December 2023.

With regards to local noise and vibration, paragraph 198 states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

Reference is made to the DEFRA Noise Policy Statement for England 2010 (NPSfE). This latter document is intended to apply to all forms of noise other than that which occurs in the workplace and includes environmental noise and neighbourhood noise in all forms.

The NPSfE advises that the impact of noise should be assessed on the basis of adverse and significant effect but does not provide any specific guidance on assessment methods or limit sound levels. Moreover, the document advises that it is not possible to have *"a single objective noise-based measure…that is applicable to all sources of noise in all situations".* It further advises that the sound level at which an adverse effect occurs is *"likely to be different for different noise sources, for different receptors and at different times".*

In the absence of specific guidance for assessment of environmental noise within the NPPF and the NPSfE, it is considered appropriate to base assessment on current British Standards and national guidance. These are considered to be Local Authority guidance, BS 4142 (2), BS 8233 (3) and the World Health Organisations (4) (WHO) guidelines.

3.2 BS 4142: 2014 + A1: 2019 – Methods for rating and assessing industrial and commercial sound.

Current Government advice to Local Planning Authorities in both England and Wales makes reference to BS 4142 as being the appropriate guidance for assessing commercial operations and fixed building services plant noise. This British Standard provides an objective method for rating the likelihood of complaint from industrial and commercial operations. It also describes means of determining noise levels from fixed plant installations and determining the background noise levels that prevail on a site.

The assessment of impacts is based on the subtraction of the measured background noise level from the rating level determined. The rating level is the source noise level (either measured or predicted) corrected for tone or character (if necessary). The difference is compared to the following criteria to evaluate the impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact.
- A difference of around +5 dB indicates is likely to be an indication of an adverse impact.
- Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact.

This method is only applicable for external noise levels.

3.3 Local planning policy.

3.3.1 Reading Borough Council.

Reading Borough Council have issued the following comments in relation to the proposed application:

"Noise & Vibration Impact Assessment (Section 16)

A noise assessment is required due to the proximity of the air conditioning unit to residential housing on Fobney Street.

Noise Assessments should be prepared by suitably qualified acousticians. They should usually outline the existing noise environment, the potential noise sources from the development, or the noise sources likely to affect the development, together with any mitigation measures. Advice should be sought from the council's Public Protection Service for individual requirements. (BS4142).

The assessment should include information about: the sound power level and the likely resultant noise level of equipment at the site boundary for all noise-producing machinery such as extract ventilation systems, refrigeration equipment etc. that is likely to be installed; where any noise-generating plant or equipment will be located and installed so as to reduce noise impacts on neighbouring properties; delivery times and opening hours for commercial premises within noise sensitive areas; details of waste collection for example pubs/clubs where glass collection could be noisy.

Pursuant to Policy EN17 all development should ensure that noise level should be at least 10dBA below existing background levels."

3.4 Proposed standards.

3.4.1 Building services – noise.

On the basis of guidance provided by Reading Borough Council and in line with Policy EN17, noise emissions from building services plant associated with the development shall be designed to achieve the following noise levels at 1m from the nearest noise sensitive receptor.

Description of noise source	Noise emission limit
Building services plant	$L_{Ar,Tr} = L_{A90,T} - 10$ dB

Table 1: Noise emission limits for building services.

4. Environmental noise survey.

Reference is made to a previous acoustic survey carried out by Hoare Lea as part of the planning application for the change of use of part of the existing shopping centre. Full details of the noise survey are provided in Appendix B. For ease of reference, a summary of the noise survey is provided below.

4.1 Results summary.

A summary of the results from the noise survey conducted by Hoare Lea in 2019 is provided in Table 2 below. For ease of reference, Figure 3 below shows the position of the measurement locations as detailed within the Hoare Lea report.

Measurement position	Time period	Typical $L_{Aeq,T}$ dB	Lowest $L_{A90,T}$ dB
L1	Daytime (0700 to 2300)	59	49
	Night-time (2300 to 0700)	53	44
P1	Daytime (1330 to 1400)	67	58

Table 2: Measured noise levels.

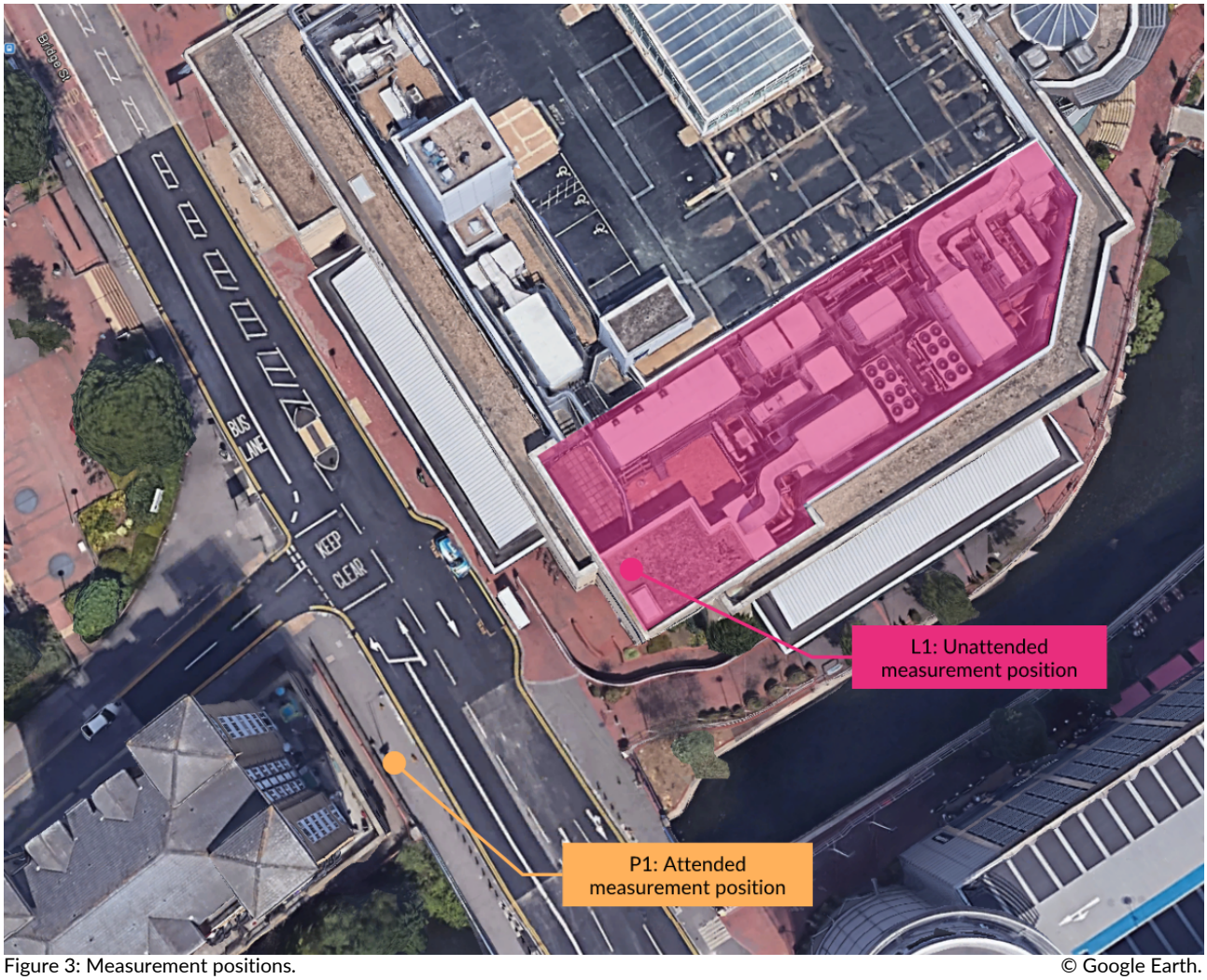


Figure 3: Measurement positions. © Google Earth.

4.2 Noise emissions of fixed plant.

On the basis of the measured background noise levels, the following noise emission limits were defined within the environmental noise survey. These are replicated in Table 3 below.

Period	Background Noise Level $L_{A90,15min}$ dB	Noise Emission Limit Calculation $L_{Ar,Tr}$ dB
Daytime (0700 to 2300)	53	43
Night-time (2300 to 0700)	45	35

Table 3: Building services noise emission limits at nearest residential receptors.

5. Noise sensitive areas.

A noise sensitive area is defined as landscapes or buildings where the occupiers are likely to be sensitive to noise created by new plant installed as part of the proposed development, including residential areas.

The nearest sensitive receptor is therefore identified as existing residential dwellings within Riverside House to the west (approximately 49m to the west of the proposed plant zone), as indicated in Figure 4 below.

Figure 4: Nearest noise sensitive receptor. © Google Earth.

6. Building services plant.

The current proposal is understood to locate nine condenser units and a single air handling unit within the existing plant compound at roof level as shown in Figure 5 below.

It is understood that the store opening hours are 0930 to 2000 Monday to Friday, 0900 to 1900 on Saturdays and 1100 to 1700 on Sundays and that the proposed building services plant will operate for a maximum of an hour before the store opens and after the store closes (0830 to 2100 Monday to Friday, 0800 to 2000 on Saturdays and 1000 to 1800 on Sundays).

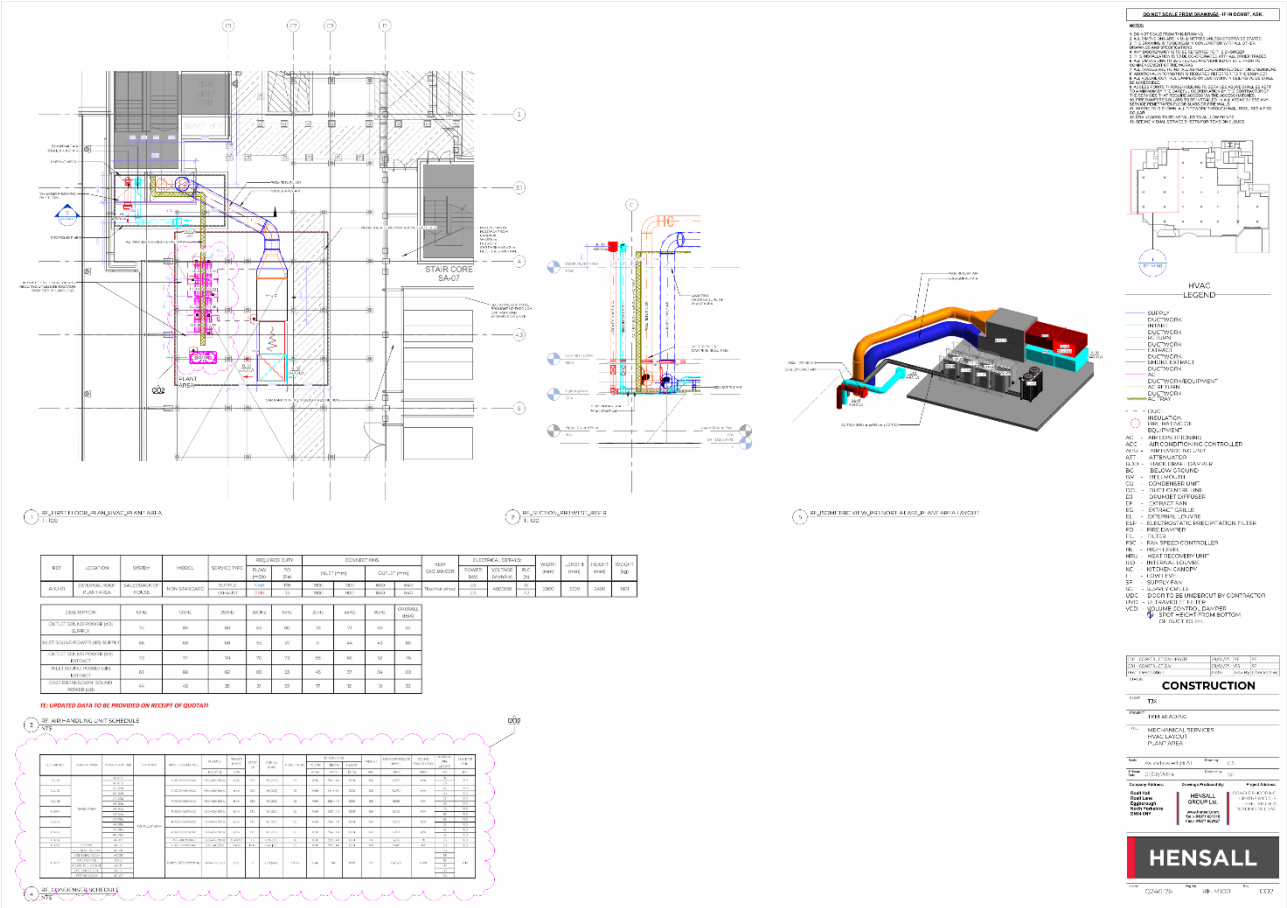


Figure 5: Indicative plant layout.

An assessment of the noise emissions from the condenser units and air handling unit has been undertaken to ensure compliance with the building noise emission limits provided in Table 3 above. The manufacturers' acoustic data has been used for each item of plant and is provided in Appendices D and E attached. In addition, a schedule of the proposed condenser units is provided in Appendix C.

The resultant sound pressure level one metre from the nearest residential dwellings at Riverside House (approximately 48m from the plant zone) has been calculated using the principles of ISO 9613-2 (5) and compared to the defined building services noise emission limits.

The assessment also takes into consideration the screening provided by the plant screen and parapet wall surrounding the plant zone. The level of screening provided depends on the following parameters:

- The distances between each item of plant and the plant screen / parapet wall.
- The distance between the plant screen / parapet wall and the receiver.
- The relative height of the plant, the plant screen / parapet wall and receiver.

In order to determine the level of screening provided by the plant screen and parapet wall, predictions have been undertaken using in-house software on the basis of the principles of ISO 9613-2. Figure 6below provides an example of the output from the software identifying the predicted screening for condenser units 01 to 06 to a receiver at sixth floor level of Riverside House.

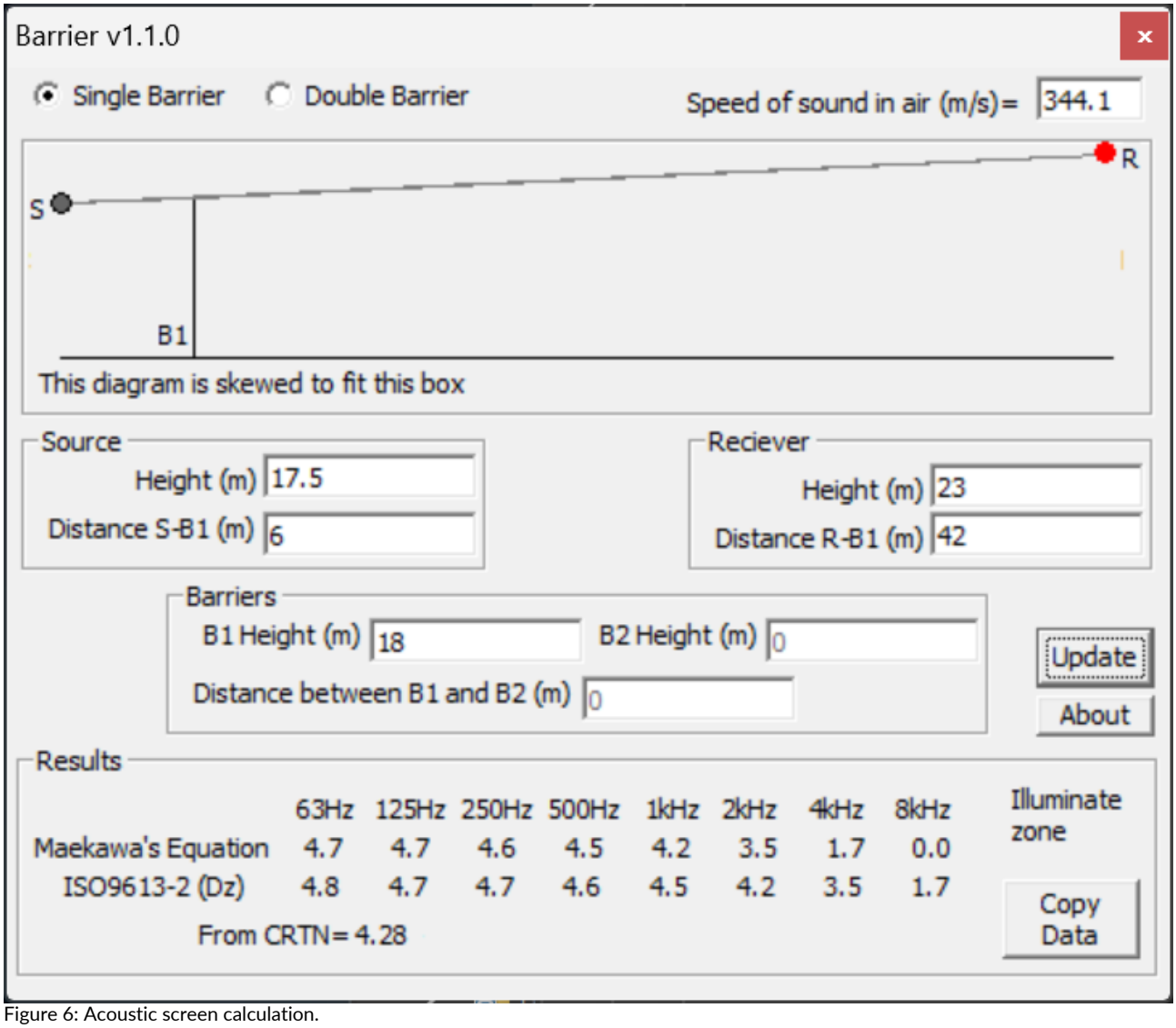


Figure 6: Acoustic screen calculation.

The most appropriate way of determining noise emissions from multiple items of building services plant is through the use of the individual source sound power levels. Whilst this data is not readily available, an area correction (based on the surface area at one metre from the unit) can be applied to the sound pressure levels to estimate the source sound power levels. The following table summarises the manufacturers stated sound pressure level at one metre and the predicted sound power level of each condenser unit.

Condenser unit reference	Model	Manufacturers sound pressure level at 1m dB(A)	Predicted sound power level L_{wA} dB
CU-01, 02, 03, 04, 05 & 06	PUZ-ZM250YKA2	62	77
CU-07	PUZ-ZM125YKA2	52	67
CU-08	PUZ-ZM100VKA2	51	66
CU-09	PURY-EP350YNW-A2	64	80

Table 4: Condenser units - predicted sound power levels.

The following table provides the fan and casing sound power levels for the proposed air handling unit.

AHU	Sound power level per octave band frequency in Hz dB								L_{wA} dB
	63	125	250	500	1000	2000	4000	8000	
Supply – inlet	66	69	68	65	57	51	44	43	65
Extract – outlet	70	77	70	70	72	68	65	62	76
Casing radiated	44	45	35	31	22	17	12	10	33

Table 5: Air Handling Unit (AHU) - sound power levels.

The methodology used to determine noise emissions at the nearest noise sensitive receptor for each item of plant are as follows:

1. Apply a distance correction to the sound power level ($L_{w(man)}$) for the distance to the noise sensitive receptor (r) assuming hemispherical sound propagation:

$$Distance\ Correction = 20\ \log_{10} r\ +\ 8$$

1. Derive the screening provided by the boundary fence *(Screening)*.
2. Derive L_p at receiver location based on the manufacturers sound power level ($L_{w(man)}$) using following equation:

$$L_{p(receiver)} = L_{w(man)} - Distance\ Correction - Screening$$

3. Predict sound pressure level for all units in operation.

Condenser unit reference	Estimated L_{wA} dB	Distance correction dB	Screening dB	Predicted sound pressure level dB(A)
CU-01, 02, 03, 04, 05 & 06	77	-42 (48m)	-4	39*
CU-07	67	-42 (48m)	-4	21
CU-08	66	-42 (48m)	-4	20
CU-09	80	-42 (48m)	-1	37
Predicted sound pressure level (combined)				41

Table 6: Predicted noise level from condensers at residential dwellings at Riverside House.

*Note *: Predicted sound pressure level using multiple units i.e., all units with same L_{wA}.*

AHU reference	L_{wA} dB	Distance correction dB	Directivity factor (based on louvre area)	Screening dB	Predicted sound pressure level dB(A)
Supply – inlet	65	-42 (48m)	-7	-5	11
Extract – outlet	76	-42 (48m)	-12	-5	17
Casing radiated	33	-42 (48m)	-	-5	0
Predicted sound pressure level (combined)					18

Table 7: Predicted noise level from AHU at residential dwellings on Riverside House.

*Note *: Directivity factor derived from guidance provided within "Fläkt Woods Practical Guide to Noise Control".*

From Tables 6 and 7 it can be seen that the predicted sound pressure level contributions at the nearest residential dwellings within Riverside House is 41 dB(A) from the condenser units and 18 dB(A) from the air handling unit (AHU). Combining these predictions results in a total noise level of 41 dB(A). Comparison with the proposed external noise limits is presented in Table 8 below.

Period	Plant noise limit $L_{Ar,Tr}$ dB	Predicted plant noise level $L_{Aeq,T}$ dB
Daytime (0700 to 2300)	43	41

Table 8: Plant noise limit and predicted noise level – Riverside House.

From Table 8 it can be seen that the combined noise emissions achieve the noise emissions limit without any requirement for further mitigation measures at the residential dwellings. As such, the plant can operate during the daytime and achieve compliance with the noise emissions at the nearest noise sensitive receptors.

Noise levels at sensitive receptors located at further distances as well as those at lower levels within Riverside House where the screening provided will be higher, would be lower than those predicted above and therefore acceptable in terms of their noise exposure.

It should be noted that the assessment provided within this Section is considered worst case as it assumes that all plant is operating at maximum duty. In reality, this is extremely unlikely and therefore noise levels are likely to be significantly lower during most periods of the working day.

7. Summary & conclusions.

Hoare Lea has conducted a noise impact assessment of building services plant serving the proposed TK Maxx Store within the Oracle Shopping Centre in Reading in conjunction with a previous environmental noise survey conducted in 2019.

In accordance with the Local Authority's comments, reference is made to background noise levels measured by Hoare Lea in September 2019 and used to define building services plant at the nearest noise sensitive receptors. The nearest noise sensitive receptors have been identified as existing residential dwellings within Riverside House to the west of the proposed store.

It is understood that the store opening hours are 0930 to 2000 Monday to Friday, 0900 to 1900 on Saturdays and 1100 to 1700 on Sundays and that the proposed building services plant will operate for a maximum of an hour before the store opens and after the store closes (0830 to 2100 Monday to Friday, 0800 to 2000 on Saturdays and 1000 to 1800 on Sundays).

During the time in which the proposed plant will be operational, the combined building services plant noise emission contribution limit advised is 43 dB(A), one metre from the nearest noise sensitive residential receptor.

An assessment of noise associated with the proposed items of building services plant has been undertaken. The predicted noise level achieves the defined noise emission limit at the residential receptors during the daytime without any requirement for further mitigation measures. The proposed plant is not required to operate during the night-time.

The guidance provided within this report is sufficient to satisfy the requirements of the Reading Borough Council, in our opinion.

This assessment has been conducted by Tom Hills who is a Charted Engineer and a Member of the Institute of Acoustics and hold a First-Class Masters in Acoustic Engineering. Hoare Lea Acoustics area also a member organisation of the ANC.

8. References.

1. *National Planning Policy Framework, Department for Communities and Local Government, December 2024.*
2. *BS 4142: 2014 + A1: 2019: 'Method for rating and assessing industrial and commercial sound'.*
3. *BS 8233: 2014, "Guidance on Sound Insulation and Noise Reduction for Buildings", BSI.*
4. *World Health Organisation (WHO) - Environmental Noise Guidelines for the European Region, 2018.*
5. *ISO 9613-2: 1996, 'Acoustics - Attenuation of Sound during Propogation Outdoors - Part 2'.*

Appendix A – Acoustic terminology.

Sound
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

The Sound Pressure
The Sound Pressure is the force (N) of sound on a surface area (m2) perpendicular to the direction of the sound. The SI-units for the Sound Pressure are Nm-2 or Pa (Pascal).

Sound is measured with microphones responding proportionally to the sound pressure – p. The power is proportional to the square of the sound pressure.

The Sound Pressure Level
The human ear has an approximately logarithmic response to sound pressure over a very large dynamic range. The lowest audible sound pressure approximately 2 x 10-5 Pa (2 ten billionths of an atmosphere) and the highest is approximately 100 Pa.

It is therefore convenient to express the sound pressure as a logarithmic decibel scale related to this lowest human audible sound, where:

$$L_p = 10\ \log\left(\frac{p^2}{{p_{ref}}^2}\right) = 10\ \log\left(\frac{p}{p_{ref}}\right)^2 = 20\ \log\left(\frac{p}{p_{ref}}\right)$$

Where: *L_p = sound pressure level (dB)*

p = sound pressure (Pa)

p_{ref} = 2 x 10-5 – reference sound pressure (Pa)

In accordance with the logarithmic scale, doubling the sound pressure level gives an increase of 6 dB.

Decibel (dB)
The decibel is the unit used to quantify sound pressure levels as well as sound intensity and power levels.

In accordance with the logarithmic scale, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pa). Subjectively, this increase would correspond to a doubling of the perceived loudness of the sound.

Sound Pressure Level of Some Common Sources
An indication of the range of sound levels commonly found in the environment is given in the following Table.

Source	Sound Pressure Level dB
Threshold of Hearing	0
Rustling Leaves	20
Quiet Whisper	30
Home	40
Quiet Street	50
Conversation	60
Inside a Car	70
Loud Singing	80
Motorcycle (10m)	90
Lawn Mower (1m)	100
Diesel Truck (1m)	110
Amplified Music (1m)	120
Jet Plane (1m)	130

Frequency
The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz) or cycles per second.

Octave and Third Octave Bands
An octave is the interval between two points where the frequency at the second point is twice the frequency of the first.

There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz.

Third octave bands provided a fine resolution by dividing each octave band into three bands. For examples, third octave bands would be 160 Hz, 250 Hz and 315 Hz for the same 250 Hz octave band.

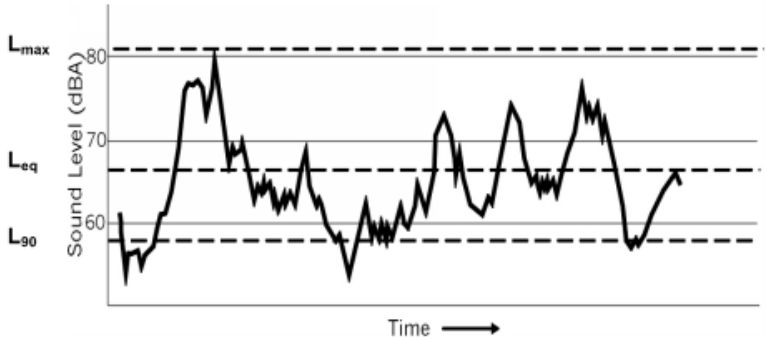
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting.

A-Weighting
The A-weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

An A weighted value would be written as dB(A) or including A within the parameter term.

Noise Units
In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as five minutes, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



$L_{eq,T}$
The $L_{eq,T}$ is a parameter defined as the equivalent continuous sound pressure level over a defined time period 'T'. It is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal.

The $L_{eq,T}$ can be thought of as an 'average' sound pressure level over a given time period (although it is not an arithmetic average). Typically, the $L_{eq,T}$ will be an A-weighted noise level in dB(A) and is commonly used to describe all types of environmental noise sources.

$L_{01,T}$
The $L_{01,T}$ is a parameter defined as the sound pressure level exceeded for 1% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter.

$L_{10,T}$
The $L_{10,T}$ is a parameter defined as the sound pressure level exceeded for 10% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe road traffic noise.

$L_{90,T}$
The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'.

It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe the prevailing background noise level.

$L_{max,T}$
The $L_{max,T}$ is a parameter defined as the maximum noise level measured during the specified period 'T'.

Specific Noise Level, $L_{Aeq,Tr}$.
This is the equivalent continuous A-weighted sound pressure level at the assessment position due to a specific noise source operating over a given time interval.

Free Field
A measurement taken in the free field is at least 3.5m from reflecting vertical surfaces and 1.2m from the ground.

Façade
A measurement is influenced by the reflection of sound from the façade of a building within 3.5m. A façade measurement is made 1m in front of the vertical building surface.

R_w
A single-number quantity which characterizes the airborne sound insulation of a material or building element in the laboratory. See BS EN ISO 717-1: 1997.

Appendix B – Noise Impact Assessment.

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HOF Oracle. Reading.

The Oracle Shopping Centre Limited.

ACOUSTICS

NOISE IMPACT ASSESSMENT

REVISION 5 – 02 JUNE 2020

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
0	18/09/2019	Internal for review.	BHJ	JNB	JNB
1	19/09/2019	Draft issue.	BHJ	JNB	JNB
2	26/09/2019	Final issue.	BHJ	JNB	JNB
3	22/10/2019	Incorporating comments.	SRG	JNB	JNB
4	15/11/2019	Updated Local Plan and minor amendments.	SRG	JNB	JNB
5	02/06/2020	Updated plant areas and roof plan included.	SRG	JNB	JNB

This document has been prepared for The Oracle Shopping Centre Limited only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

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Executive summary.

A change of use in part of the existing shopping centre The Oracle in Reading has been proposed.

National and Local Planning Policy have been reviewed and operational noise limits proposed.

Hoare Lea has carried out an acoustic survey at the site to inform a noise impact assessment and derive noise limits for each plant area associated with the proposed redevelopment. A review of the potential impact of the new uses within the redevelopment affecting residential neighbours has been undertaken.

The assessment indicates that there is a low impact in respect of noise and vibration from the change in use.

1. Introduction.

A change of use to part of the existing shopping centre The Oracle in Reading is proposed. Current retail use in the centre is proposed to be replaced with various uses described in this report.

The Oracle Shopping Centre Limited has appointed Hoare Lea LLP to carry out an acoustic assessment of the noise impact of fixed plant and potential internal activity associated with the proposed development affecting nearby residential receptors.

The following is provided in this report:

- A site description.
- Summaries of the relevant policy and guidance documents used for assessment.
- The results of noise monitoring carried out to quantify the existing noise conditions in the area.
- Proposed noise limits for fixed plant items associated with the development.
- An assessment of activity-based noise within the potential uses affecting nearby residential is provided.

This report has been prepared to support the Planning Application in respect of noise associated with the change of use.

2. Site description.

Figure 1 shows the proposed development in relation to the nearest noise sensitive receptor and the surrounding area.

The proposal is for the subdivision of three-storey retail unit (Class A1) and change of use to form: 1 x flexible retail/restaurant/bar unit (Class A1/A3/A4); 1 x flexible retail/restaurant unit (Class A1/A3) and 1 x assembly and leisure unit (Class D2) at Riverside level; 1 x retail unit (Class A1) and 1 x assembly and leisure unit (Class D2) at lower ground level; 1 x retail unit (Class A1) at upper ground level, together with alterations to the Riverside frontage and associated plant, car parking and external alterations at car park levels.

The nearest noise sensitive receptor is an apartment building called Riverside House. This is to the south-west of the development, situated on the other side of Bridge Street.

Road traffic noise is the dominant source of noise in the area and primarily dictates residual and background sound levels around the development site. In detail, this consists of constant noise from traffic on the A329 (south-east of the development site), and intermittent noise from vehicles close to the receptor on Bridge Street (south-west of the development site).

Due to the close vicinity to The Oracle, many pedestrians and cyclists pass Riverside House. This adds to the noise environment.

Figure 1: Site position and surrounding area.

Whilst House of Fraser has the footprint shown in Figure 1, the plant area associated with the development is a more limited space. This area is shown more clearly in Figure 2 (in Section 5.1).

3. Planning policy and published guidance.

3.1 Noise Policy Statement for England.

The *Noise Policy Statement for England* (NPSE) (Department for Food, Environment and Rural Affairs, 2010) advises that noise impacts should be assessed on the basis of adverse and significant adverse effects, but does not provide any specific guidance on assessment methods or noise limits.

The NPSE introduces the concepts summarised in Table 1 that can be applied when considering the significance of noise impacts, which are applied by the World Health Organization.

The document advises that it is not possible to have *"a single objective noise-based measure… that is applicable to all sources of noise in all situations"*. It further advises that the sound level at which an adverse effect occurs is likely to be different for different noise sources, for different receptors at different times.

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

Table 1: NPSE observed effect levels.

3.2 National Planning Policy Framework.

The *National Planning Policy Framework* (NPPF) (Ministry of Housing, Communities & Local Government, 2019) sets out the Government's planning policies and how these are expected to be applied. In relation to noise and vibration, NPPF section 15 paragraph 170 states:

"The planning system should contribute to and enhance the natural and local environment by:

…

- *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…"*

Whilst paragraph 180 states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;*

…"

3.3 Planning Practice Guidance.

Online *Planning Practice Guidance* (PPG) (Ministry of Housing, Communities & Local Government, 2019) has been published to provide greater details in relation to the relevance of noise to the planning process following the introduction of the NPPF and NPSE.

This guidance states, under the heading *'How can noise impacts be determined?'*, that:

"Plan-making and decision making should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved."*

In line with NPSE, this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation during the operation of the Proposed Development.

Further guidance on each of the various observed effect levels set out in the NPSE is provided in the table detailed in the section headed *'How to Recognise when Noise could be a concern?'* which is reproduced below in Table 2.

It is important to note that no specific noise parameters are defined in the text or target noise levels provided. Under the heading *'What factors influence whether noise could be a Concern?'*, the subjective nature of noise is discussed. It is stated that there is no simple relationship between noise levels and the impact on those affected. This depends on how various factors combine in particular situations.

Perception	Example of outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not Intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.		No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and Intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect Level	Avoid
Noticeable and disruptive	Extensive and regular changes in behaviour and/or inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Table 2: PPG observed effects.

3.4 Local planning policy – Reading Borough Council.

Reading Borough Council's (RBC's) Local Plan was adopted on 4th November 2019 (Reading Borough Council, 2019). This includes three policies relating to noise. These are presented below:

CC8: SAFEGUARDING AMENITY

Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

- *…*
- *Noise and disturbance;*
- *…*

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy.

As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable.

Where an otherwise acceptable development could change its character to a use that would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes.

EN16: POLLUTION AND WATER RESOURCES

Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution; where it would result in no deterioration in, or ideally enhance, ground and surface water quality; and where adequate water resources, sewerage and wastewater treatment infrastructure will be in place to support the proposed development prior to occupation.

Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution….

EN17: NOISE GENERATING EQUIPMENT

Where noise generating equipment is proposed, the noise source specific level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor.

Consultation with the Local Authority at the Pre-Application meeting identified a requirement to assess noise and vibration from the development affecting existing residential use.

3.5 British Standard 4142:2014 Methods for rating and assessing industrial and commercial sound.

Current Government advice to Local Planning Authorities in both England and Wales makes reference to British Standard 4142:2014 (BS 4142) (British Standards Institution, 2014) as being the appropriate guidance for assessing commercial operations and fixed building services plant noise. The British Standard provides an objective method for rating the significance of impact from industrial and commercial operations. It describes a means of determining sound levels from fixed plant installations and determining the background sound levels that prevail on a site.

The assessment of the impacts is based on the subtraction of the pre-existing background sound level ($L_{A90,T}$) from the rating level ($L_{Ar,Tr}$).

The standard does not give a definitive method for determining the background sound level but instead, as a commentary, states that *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods"*.

Clause 8.1.4, which discusses the monitoring duration, states *"there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."* As a note to this clause the following commentary is given on obtaining a representative backgrounds sound level:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB(A)), impulsivity (up to +9 dB(A)), intermittency (+3 dB(A)) and other sound characteristics (+3 dB(A)) which may be determined either subjectively or objectively, if necessary.

The background sound level is subtracted from the rating level for assessment against the following criteria:

- A difference of around +10 dB is likely to be an indication of a significant adverse impact, depending on context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context; and
- A difference of +0 dB or less is an indication of the specific sound source having a low impact, depending on the context.

3.6 DEFRA Noise from Pubs and Clubs (Phase II) May 2006.

There is limited information available in respect of acceptability of entertainment-based noise. The Noise from Pubs and Clubs guidance (NANR 163) mainly refers to disturbance due to music type entertainment. The guidance from NANR 163 has the following semantic descriptions for noise intrusion to dwellings.

Semantic Descriptor	Source	Absolute $L_{Aeq(5\ minutes)}$
Clearly acceptable	1	17.0 dB
	2	20.4 dB
	3	23.8 dB
	4	27.2 dB
Just acceptable	5	30.6 dB
Just unacceptable	6	34.0 dB
	7	37.4 dB
	8	40.8 dB
	9	44.2 dB
Clearly unacceptable	10	47.5 dB

Table 3: Semantic Noise Descriptors Entertainment Noise.

Whilst this is not strictly applicable to the situation an indication of the acceptability of noise intrusion can be assessed from these values.

These are internal noise levels, a reasonable expectation attenuation for an open window is 12 dB.

4. Acoustic survey.

An acoustic survey has been undertaken to quantify the prevailing noise conditions at the site.

Plant noise and the A329 were the dominant sources of noise influencing noise level measurements at all measurement positions. Frequent short-term events such as passing pedestrians, cyclists and vehicles on Bridge Street were also noted.

4.1 Methodology.

An unattended survey was undertaken between Thursday 12th September 2019 and Tuesday 17th September 2019 at the proposed development site. The location of the sound level meter used in this survey is shown at L1 in Figure 2. This location was observed to have a comparable general noise climate to the nearest residential receiver. Any exception would be due to ground level noise sources.

Attended measurements were also carried out at the nearest identified noise sensitive receptor, shown as P1 in Figure 2, on Tuesday 10th September 2019.

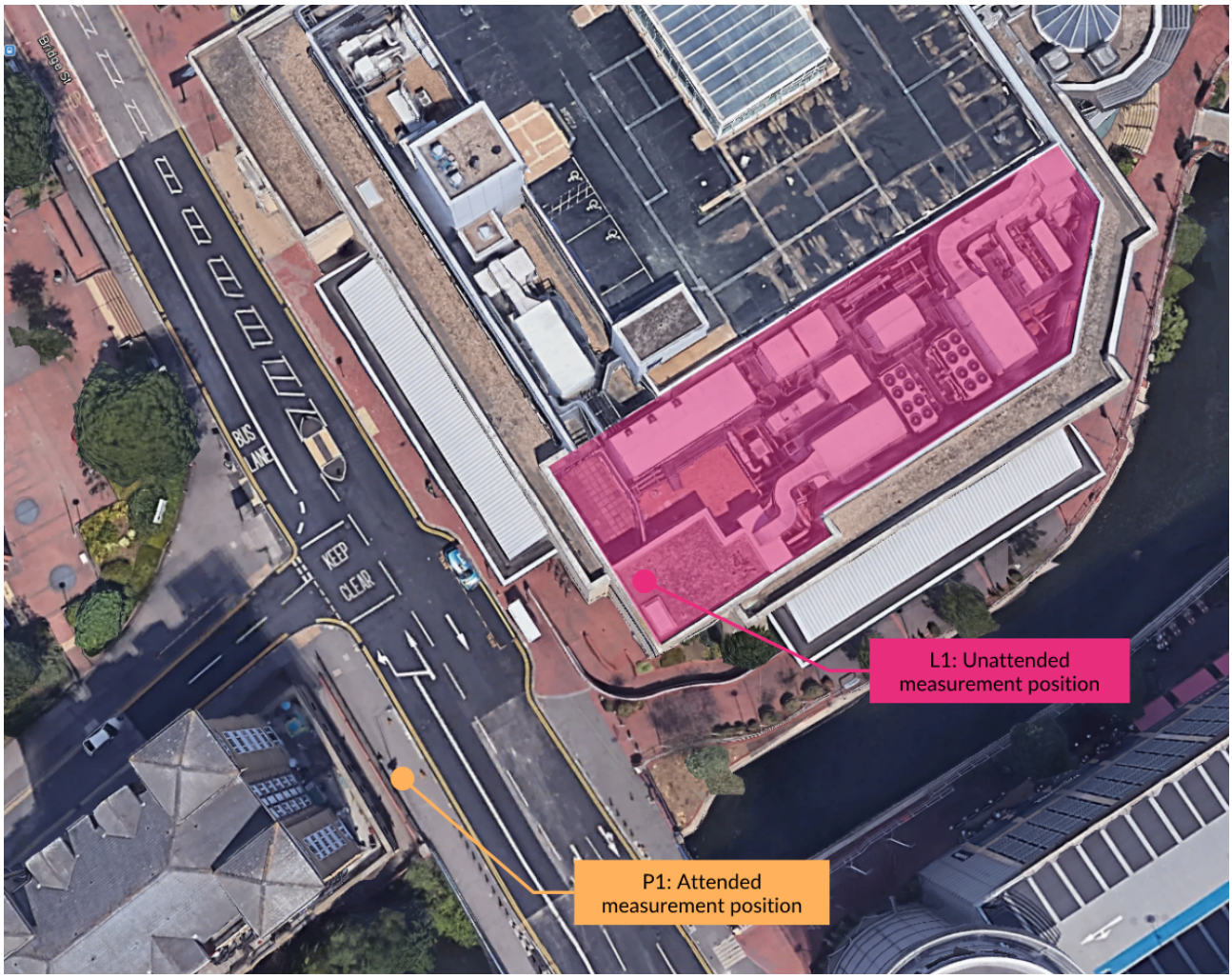


Figure 2: Attended and unattended measurement positions

For all measurements, the microphone was positioned at a height of approximately 1.4 metres above ground level and under free-field conditions.

Measurements recorded included fifteen-minute duration samples of ambient sound levels ($L_{Aeq,15min}$) and background sound levels ($L_{A90,15min}$).

During the survey, wind speeds were generally low, and no precipitation was recorded.

The acoustic survey equipment was field calibrated immediately before and immediately after the measurement period; no significant drift in level was found to have occurred. The acoustic measurement instrumentation used is listed in Appendix A attached.

4.2 Results.

A time history plot of the measure sound levels at L1 is provided in Appendix B attached.

4.2.1 Ambient sound levels.

Table 4 shows the ambient sound pressure levels measured at P1 on Tuesday 10th September 2019.

Period	Time	Ambient sound pressure level
1	13:30 – 13:45	$L_{Aeq,15min}$ 67 dB
2	13:45 – 14:00	$L_{Aeq,15min}$ 66 dB

Table 4: Ambient sound pressure levels measured at P1

Table 5 shows the ambient sound pressure levels measured at L1

Date	Ambient sound pressure levels measured (dB) at position HOF Roof	
	Day Time (07:00 - 23:00) $L_{Aeq, 16hr}$	Night Time (23:00 - 07:00) $L_{Aeq, 8hr}$
12/09/2019	59 dB	53 dB
13/09/2019	59 dB	53 dB
14/09/2019	58 dB	54 dB
15/09/2019	58 dB	53 dB
16/09/2019	59 dB	53 dB
17/09/2019	58 dB	-

Table 5: Ambient sound pressure levels measured at L1

It should be noted that the sound pressure levels shown for Thursday 12th September and Tuesday 17th September (highlighted) are not complete 16-hour averages.

4.2.2 Background sound levels.

Table 6 shows the background sound pressure levels at P1 on Tuesday 10th September 2019.

Period	Time	Background sound pressure level
1	13:30 – 13:45	$L_{A90,15min}$ 58 dB
2	13:45 – 14:00	$L_{A90,15min}$ 58 dB

Table 6: Background sound pressure levels measured at P1

Table 7 shows the background sound pressure levels measured at L1.

Date	Background sound pressure levels measured (dB) at position HOF Roof	
	Daytime (07:00 - 23:00) Lowest $L_{A90,15min}$	Night-time (23:00 - 07:00) Lowest $L_{A90,15min}$
12/09/2019	50 dB	44 dB
13/09/2019	52 dB	46 dB
14/09/2019	53 dB	45 dB
15/09/2019	49 dB	44 dB
16/09/2019	50 dB	45 dB
17/09/2019	54 dB	

Table 7: Background sound pressure levels measured at L1

As background sound levels at L1 are comparable to the attended $L_{A90,15min}$ measurements, it is proposed that L1 shall be used as a proxy to define plant limits at all nearby noise sensitive residential receptors. Where the attended measurements are greater than the background levels measured at L1, this is due to the attended measurements taking place closer to Bridge Street the A329. Therefore, using the measurement results at L1 to set the noise limits is a conservative methodology.

4.2.3 Statistical analysis.

In line with the guidance given in BS 4142, to *"quantify what is typical during particular time periods"*, a statistical analysis of the measured background sound levels has been undertaken.

The periods of interest for this development are daytime and night-time. Daytime is taken as between the hours of 07:00 and 23:00. Night-time is taken as between the hours of 23:00 and 07:00.

Measured 15-minute values have been used in place of a 1-hour reference time interval for daytime periods, required by BS 4142. The 15-minute duration background sound values measured during the day will never be higher than the $L_{A90,1\,h}$ for that period, so represent a conservative assessment.

Figure 3 shows an analysis of the background sound levels for daytime and night-time periods of interest at position L1. This shows the percentage of the total number of levels recorded taken up by each integer $L_{A90,15min}$ result.

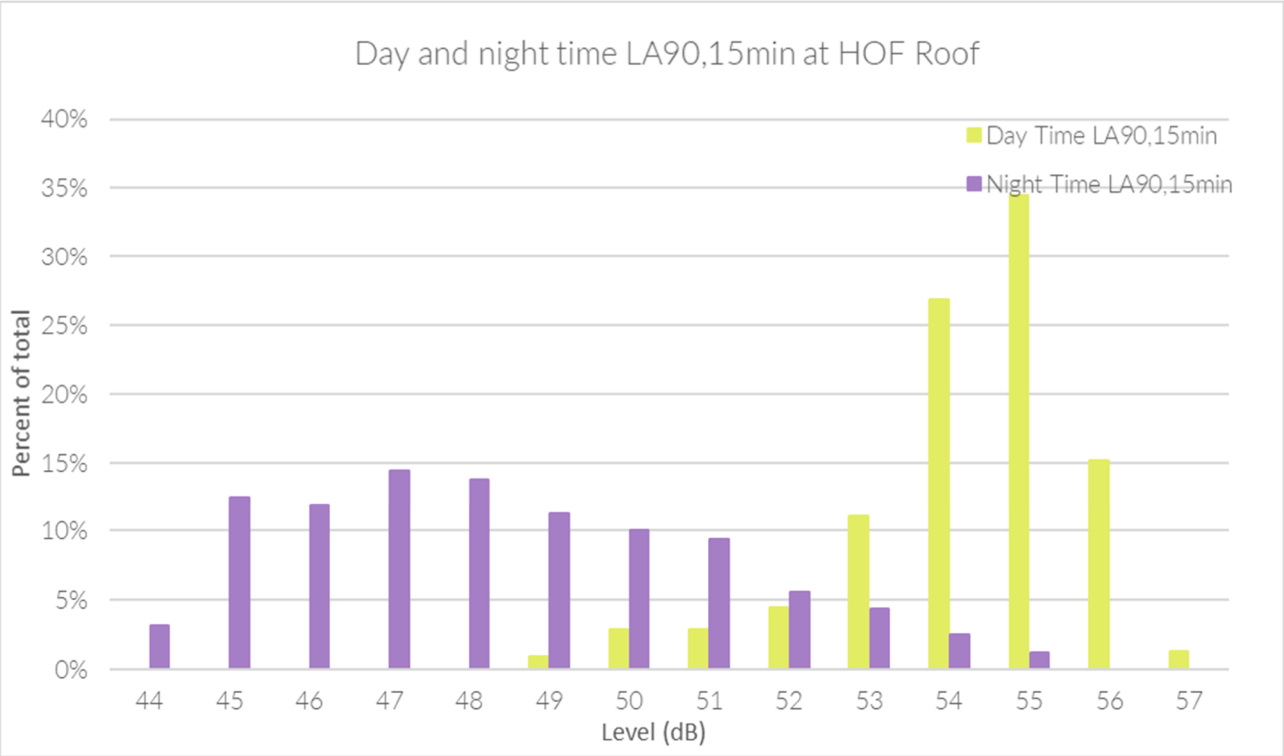


Figure 3: Statistical analysis of background sound level measurements.

From the statistical analysis chart shown in Figure 3 and the time history chart shown in Appendix B, given the context of the site, the following typical lower background sound levels have been determined as representative for the periods of interest at position L1:

Period	Background sound level
Daytime: 07:00-23:00	$L_{A90,15min}$ 53 dB
Night-time: 23:00-07:00	$L_{A90,15min}$ 45 dB

Table 8: Background sound levels

5. Plant noise emissions.

5.1 Noise limits.

Given the context of the site, a rating level ($L_{Ar,Tr}$) less than the background sound level ($L_{A90,Tr}$) would provide an indication of the specific sound source having a low impact, based on the guidance in BS 4142. Following instruction from RBC, the proposed noise limit for the installation is for the rating level to be 10 dB below the background noise level at the closest noise sensitive residential receptor.

Noise Limit: $L_{Ar,Tr} = L_{A90,Tr} - 10$ dB

This is summarised in Table 9.

Period	Background sound Level	Proposed Plant Noise Limit
Daytime: 07:00-23:00	$L_{A90,15min}$ 53 dB	$L_{Ar,15min}$ 43 dB
Night-time: 23:00-07:00	$L_{A90,15min}$ 45 dB	$L_{Ar,15min}$ 35 dB

Table 9: Proposed noise limits at nearest residential receptors

The above noise limits are given as *rating levels*. Corrections appropriate to the character of the sound should be applied in accordance with BS 4142 when calculating this from the *specific sound level*.

These limits are applicable to the total noise generated by all the fixed plant associated with the proposed redevelopment. Specific sound power levels for each plant area can be found in the following section.

5.2 Sound sources and source locations.

Five separate plant areas have been proposed on the roof of proposed redevelopment. To ensure that the proposed plant noise limits are not exceeded, the following sound power levels are applicable to each plant area. These are rating levels and any acoustic feature correction must be subtracted from the limits shown.

Plant area	Area		Distance to receiver	Proposed Sound Power Level Limit	
	Footprint	Stacked		Daytime	Night-time
R22	60 m^2	120 m^2	60 m	L_{WA} 82 dB	L_{WA} 74 dB
R23	25 m^2	-	52 m	L_{WA} 77 dB	L_{WA} 69 dB
R24	100 m^2	200 m^2	47 m	L_{WA} 80 dB	L_{WA} 72 dB
R25	140 m^2	-	80 m	L_{WA} 82 dB	L_{WA} 74 dB
L43	52 m^2	104 m^2	63 m	L_{WA} 78 dB	L_{WA} 70 dB
U48	125m^2	-	83m	L_{WA} 82 dB	L_{WA} 74 dB

Table 10: Proposed plant sound power level limits for each proposed plant area.

These limits should not be exceeded to ensure that the development has no adverse impact on the nearest identified residential receptors. The plant layout is shown in Appendix C.

The sound power limits are based on achieving the noise criteria stated at the closest residential receptors at Riverside House. Predicted noise levels at Gun Street using these values are more than 20 dB below background. This is due to the significant separation distance of 95 metres between the plant area and Gun Street. This compares to a distance of around 30 metres to Riverside House.

6. Operational noise emissions.

Whilst the eventual tenancies are uncertain at this stage, an assessment based on a Bowling Alley at first floor level has been undertaken. This use may vary in practice but for the purposes of the assessment is considered to be the worst case. The location of this use relative to Riverside House, the closest receptor, is shown in Figure 5 below:

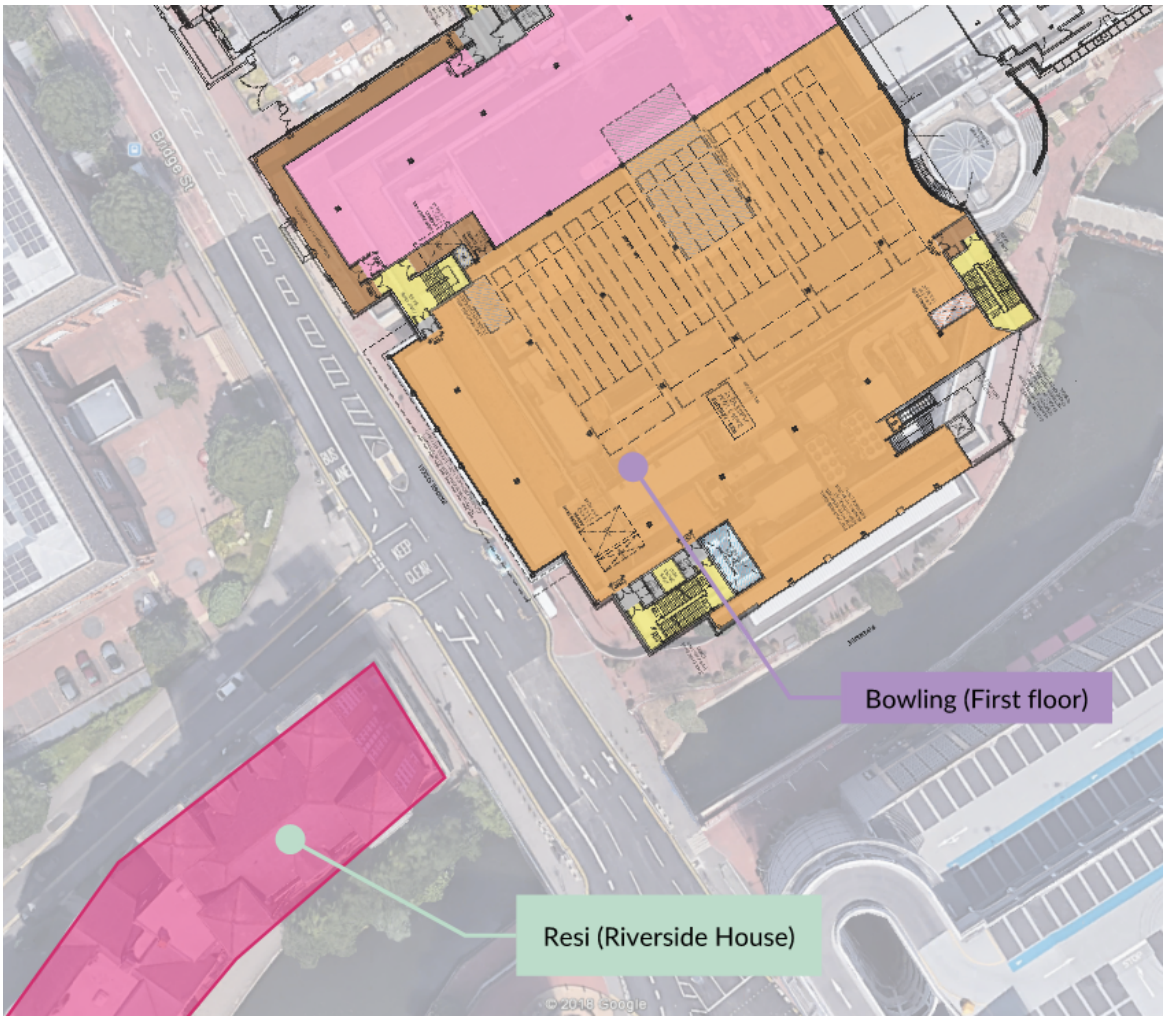


Figure 4: Gym and bowling alley locations

The separation distances to Riverside House is 25 metres from the potential Bowling Alley use.

Gun Street is considerably further away and screened by intervening buildings, this has not been considered in the assessment as Riverside House is much closer. Gun Street would be expected to be subject to considerably lower noise levels.

In respect of vibration, this use will include mitigation to avoid disturbance to neighbouring retail uses. This will be controlled by the Lease to each tenancy. At the distance to the nearest sensitive use the residual vibration level would be imperceptible.

In respect of airborne noise, a typical operational noise level within the Bowling Alley of 82 dB $L_{Aeq,T}$ the predicted noise level at Riverside House is 32 dB $L_{Aeq,T.}$ This level is derived from measurements of similar venues.

The building envelope has existing glazing, taken to be R_w 34 dB performance.

The lowest prevailing background noise level at around midnight, when trading is likely to cease, is 47 dB $L_{Aeq,T.}$ The predicted noise emissions are 15 dB below this value, this could be considered a low impact.

Allowing a 12 dB attenuation value for an open window, the internal noise level is predicted to be 20 dB $L_{Aeq,T}$. Comparing this with the semantic descriptor values in Table 3 the noise intrusion falls into the *clearly acceptable* band.

7. Summary and conclusion.

Hoare Lea LLP has carried out an acoustic assessment of the new fixed plant areas to be provided as part of the proposed redevelopment and change of use within The Oracle in Reading.

An acoustic survey has been carried out at the site to establish the prevailing noise climate at locations considered representative of the nearest noise sensitive receptors.

Noise limits for the proposed redevelopment plant have been set at 10 dB below background sound level, consistent with Local Authority guidance, based on the results of the acoustic survey. This should result in a low impact.

Plant noise limit allocations have been developed for each tenant plant area to comply with the required overall noise limit.

An assessment of operational noise levels within the Bowling Alley has been undertaken, this indicates low noise levels will be achieved. Whilst alternative uses may occur this is considered to be the worst case for the purposes of the assessment.

References.

British Standards Institution. (2014). *British Standard 4142 Methods for rating and assessing industrial and commercial sound.*

Department for Food, Environment and Rural Affairs. (2010). *Noise Policy Statement for England.*

Ministry of Housing, Communities & Local Government. (2019). *National Planning Policy Framework.*

Ministry of Housing, Communities & Local Government. (2019). *Planning Practice Guidance: Noise.*

Reading Borough Council. (2019). *Reading Borough Local Plan.*

Appendix A: Equipment details.

Attended measurement.

Equipment	Make	Model	Calibration due	Calibration cert no.
Sound Level Meter	Brüel & Kjær	2250 SN: 3004428	27/04/2020	UCRT18/1458
Pre-amplifier	Brüel & Kjær	ZC 0032 SN:19784	27/04/2020	UCRT18/1458
Microphone	Brüel & Kjær	4189 SN: 2799360	27/04/2020	UCRT18/1458
Calibrator	Brüel & Kjær	4231 SN: 2545611	30/07/2020	UCRT19/1843

Table 11: Details of the equipment used in the attended measurements at P1.

Unattended measurement.

Equipment	Make	Model	Calibration due	Calibration cert no.
Sound Level Meter	Rion	NL-52 SN: 011443560	26/04/2021	UCRT19/1523
Pre-amplifier	Rion	NH-25 SN: 43577	26/04/2021	UCRT19/1523
Microphone	Rion	UC-59 SN: 07371	26/04/2021	UCRT19/1523
Calibrator	Brüel & Kjær	4231 SN: 2545611	30/07/2020	UCRT19/1843

Table 12: Details of the equipment used in the unattended measurement at L1.

Appendix B: L1 time history.

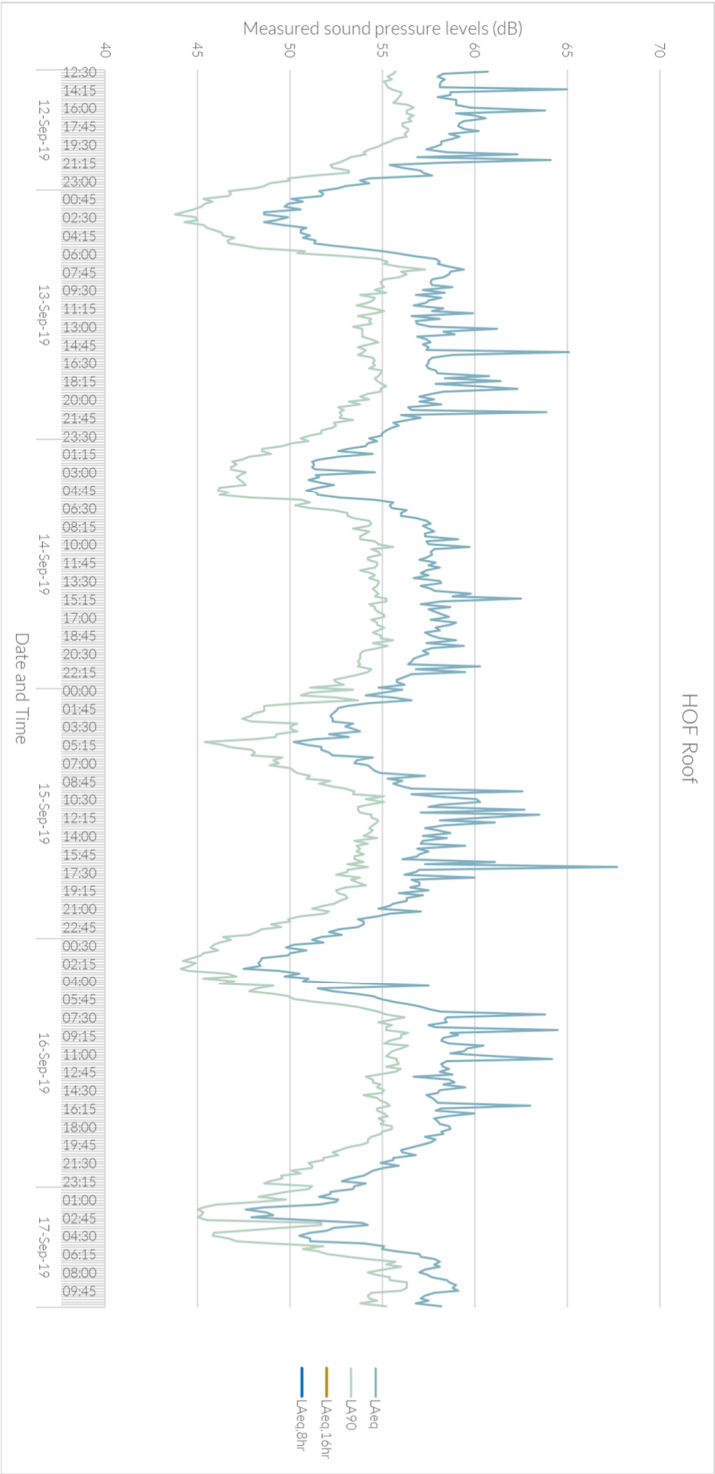
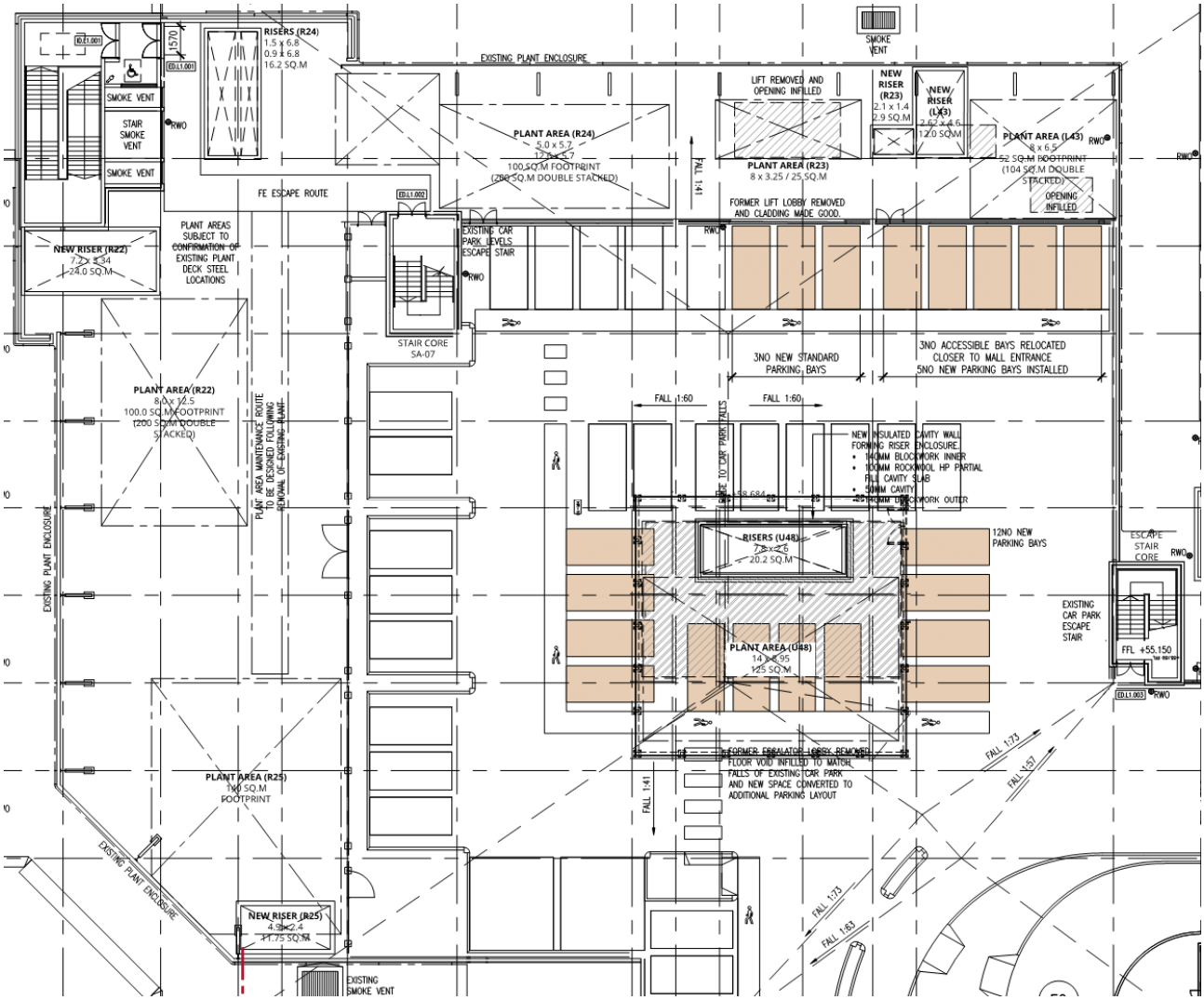


Figure 5: Time history of the ambient and background sound pressure levels measured at L1

Appendix C: Roof plant area layout.



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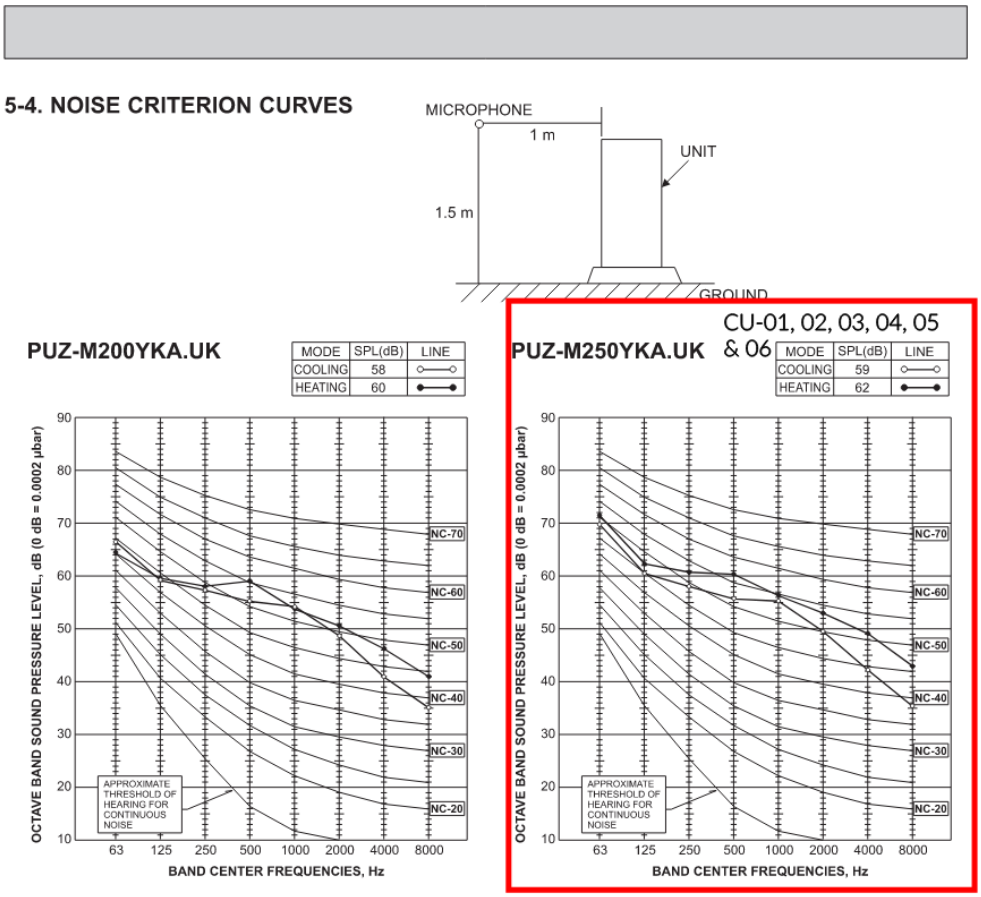
Appendix C – Condenser unit schedule.

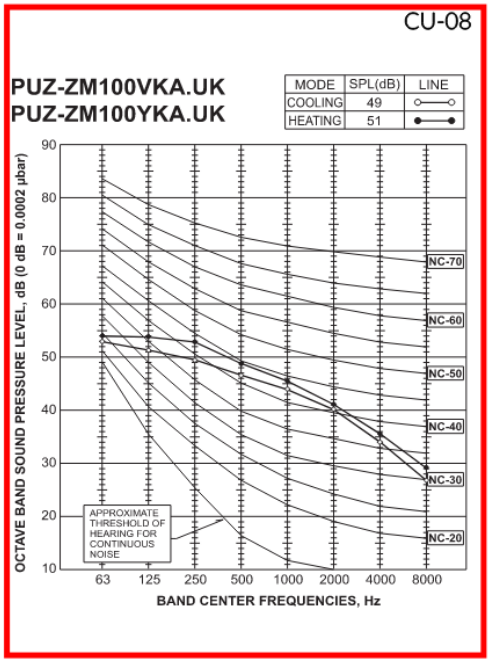
REFERENCE	AREA SERVED	INDOOR UNIT REF	LOCATION	MODEL REFERENCE	VOLTAGE	POWER INPUT	START (A)	RUN (A) (MAX)	FUSE HRC (A)	DIMENSIONS			WEIGHT	SOUND PRESSURE LEVEL	SOUND POWER LEVEL	APPROX. PIPE LENGTH	MAX PIPE RUN
										WIDTH	DEPTH	HEIGHT					
					(V/ph/Hz)	(kW)				(mm)	(mm)	(mm)	(kg)	(dBA)	(dBA)	(m)	(m)
CU-01	SALES AREA	AC-01a	EXT. PLANT AREA	PUZ-ZM250YKA2	380-415v, 50Hz	6.43	13.3	11.6 [22.5]	25	1050	330 + 40	1338	138	62/59	N/A	95	100
		AC-01b														75	
CU-02		AC-02a		PUZ-ZM250YKA2	380-415v, 50Hz	6.43	13.3	11.6 [22.5]	25	1050	331 + 40	1338	138	62/60	N/A	55	100
		AC-02b														70	
CU-03		AC-03a		PUZ-ZM250YKA2	380-415v, 50Hz	6.43	13.3	11.6 [22.5]	25	1050	332 + 40	1338	138	62/61	N/A	77	100
		AC-03b														58	
CU-04		AC-04a		PUZ-ZM250YKA2	380-415v, 50Hz	6.43	13.3	11.6 [22.5]	25	1050	333 + 40	1338	138	62/62	N/A	40	100
		AC-04b														55	
CU-05		AC-05a		PUZ-ZM250YKA2	380-415v, 50Hz	6.43	13.3	11.6 [22.5]	25	1050	334 + 40	1338	138	62/63	N/A	55	100
		AC-05b														35	
CU-06		AC-06a		PUZ-ZM250YKA2	380-415v, 50Hz	6.43	13.3	11.6 [22.5]	25	1050	334 + 40	1338	138	62/63	N/A	55	100
		AC-06b														35	
CU-07		AC-07		PUZ-ZM125YKA2	380-415v, 50Hz	3.34/2.83	3.3	8.35 [11.3]	16	1050	329 + 40	1338	114	52/50	70	75	100
CU-08	COMMS	AC-13		PUZ-ZM100VKA2	220-240/50	2.405	13.46	10.45 [27.1]	32	1050	330 + 40	1338	105	51/49	69	50	100
CU-09	CCTV/DETENSION	AC-08		PURY-EP350YNW-A2	380-415v, 50Hz	8.25	8	22.8 [24.8]	1 X 25	1240	740	1858	275	64/62.5	83/81	70	200
	INTERVIEW ROOM	AC-09														89	
	CASH OFFICE	AC-10														85	
	ASSOCIATE LOUNGE	AC-11														87	
	SYSTEMS OFFICE	AC-12														80	
	FITTING ROOM	AC-07														90	

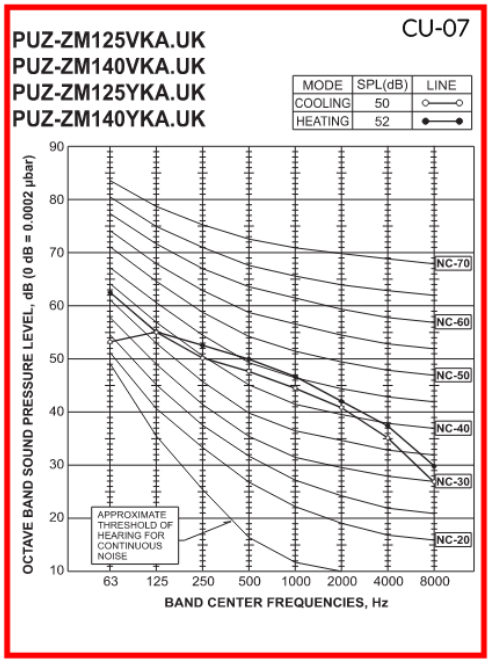
Appendix D – Manufacturer's information – Condenser units.

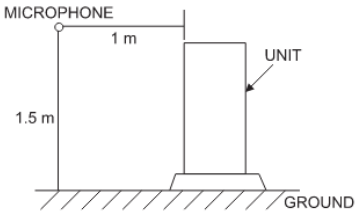


OCH737A 15

5-3. NOISE CRITERION CURVES





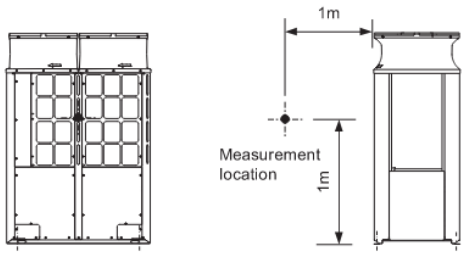


OCH654 15

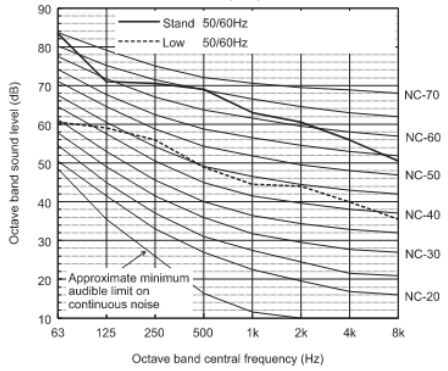
5. SOUND LEVELS

Outdoor units

Measurement condition
PURY-P350, 400, 450YNW-A(-BS)



Sound level of PURY-P450YNW-A(-BS)



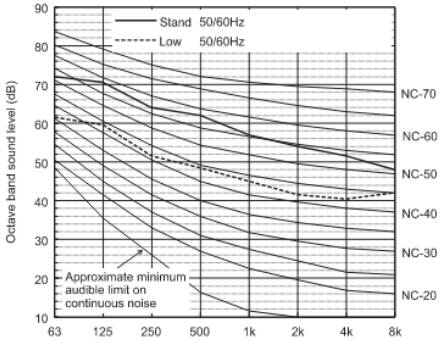
		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Heating	50/60Hz	83.5	71.0	70.5	69.0	63.0	60.5	56.0	50.5	70.0
Low noise mode	50/60Hz	60.5	59.0	56.0	49.0	44.5	44.0	40.0	35.5	53.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

PURY-P-Y(S)NW-A

CU-09

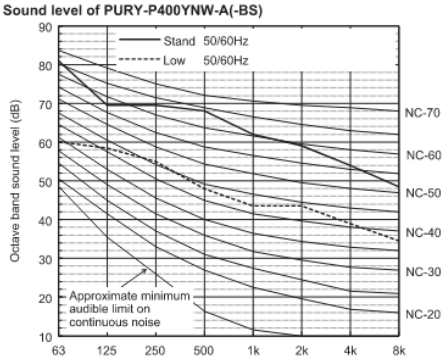
Sound level of PURY-P350YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Heating	50/60Hz	72.0	70.5	64.0	62.0	57.0	54.0	51.5	48.0	64.0
Low noise mode	50/60Hz	61.5	59.5	51.5	48.5	45.0	41.5	40.5	42.0	52.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

Sound level of PURY-P400YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Heating	50/60Hz	81.0	69.5	69.5	68.0	62.0	59.0	54.0	48.5	69.0
Low noise mode	50/60Hz	60.0	58.5	55.0	48.0	43.5	43.5	39.0	34.5	52.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

•Depending on the operation conditions, the unit generates noise caused by valve actuation, refrigerant flow, and pressure changes when operating normally. Please consider to avoid location where quietness is required.
For BC controller, it is recommended to be installed in places such as ceilings of corridor, rest rooms and plant rooms.

Appendix E – Manufacturer's information – AHU.

REF	LOCATION	SYSTEM	MODEL	SERVICE TYPE	REQUIRED DUTY		CONNECTIONS			HEAT EXCHANGER	ELECTRICAL DETAILS			WIDTH (mm)	LENGTH (mm)	HEIGHT (mm)	WEIGHT (kg)
					FLOW (m3/s)	PD (Pa)	INLET (mm)		OUTLET (mm)		POWER (kW)	VOLTAGE (V/ph/Hz)	FLC (A)				
AHU-01	EXTERNAL ROOF PLANT AREA	SALES/BACK OF HOUSE	NON-STANDARD	SUPPLY	3.148	178	1900	1000	1650	840	Thermal wheel	2.5	400/3/50	3.1	2000	3300	2400	1301
				EXHAUST	2.515	112	1900	900	1650	840		2.5		3.2				

DESCRIPTION	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	OVERALL dB(A)
OUTLET SOUND POWER (dB) SUPPLY	74	83	80	82	80	76	71	69	84
INLET SOUND POWER (dB) SUPPLY	66	69	68	65	57	51	44	43	65
OUTLET SOUND POWER (dB) EXTRACT	70	77	70	70	72	68	65	62	76
INLET SOUND POWER (dB) EXTRACT	69	66	62	60	53	45	37	34	60
CASE BREAKDOWN SOUND POWER (dB)	44	45	35	31	22	17	12	10	33

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