Kairus Ltd

Noise Assessment

Hayes Bridge Retail Park

Hillingdon

Project Reference	AQ051908NOI
Revision	V2
Issue Date	17/05/2023
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1 Introduction

1.1 General

Kairus Ltd has been commissioned to assess the impact of noise associated with a speculative commercial development at Bridgwater Retail Park, Hayes.

The assessment has been based on detailed environmental noise measurements at the site and a subsequent predictive exercise.

1.2 Scope of Assessment

The scope of the noise assessment can be summarised as follows:

- A sound monitoring survey was undertaken at a discrete location adjacent to the closest noise-sensitive receptors to the Site;
- A noise modelling exercise, in order to quantify the potential noise generation of the proposed site uses;
- An assessment of potential noise impacts with respect to the prevailing acoustic conditions at existing off-site receptors; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Practice Guidance in England: Noise[1].

Whilst every effort has been made to ensure that this report is easily understood, it is technical in nature; a glossary of terms is included in Appendix A to assist the reader.

Full results of the sound monitoring exercise undertaken are presented in Appendix B

1 Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.

2 Site Description

2.1 The Existing Site

The Proposed Development site is located at Bridgwater Retail Park, off Uxbridge Road, Hayes, as identified in Figure 2.1. The application site currently comprises retail uses.

The presence of the application site and nearest noise-sensitive receptors (NSRs) adjacent to Uxbridge Road results in the whole assessment area being entirely dominated by moderate to high levels of road traffic noise.

Figure 2.1: Location of Development Site

2.2 The Proposed Development

The proposals comprise the construction of 16,522m^2 (GIA) of use class E(g), B2 and B8 commercial development, offering 13,987m^2 of warehousing, 1,411m^2 of (2-storey) office, 805m^2 of (3-storey) office and 319m^2 of transport office, as illustrated in Figure 2.2.

At this stage, the precise end users of the units aren't known, therefore the application is for speculative development, with no anticipated restriction of opening hours. The following details regarding building services have been offered by the Applicant:

- Warehouse will be unheated with capped of services for future fit out by occupier.
- Offices will be served by VRV heating and cooling services (external condensing units), local ventilation via MVHR units (void mounted) and hot water services from localised electric water heaters.

Figure 2.2: Layout of Proposed Development

3 Policy Context

3.1 National Planning Policy Framework, 2021

The National Planning Policy Framework (NPPF)[2] sets out the Government's planning policies for England. Planning policy requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise.

The NPPF is also a material consideration in planning decisions. It sets out the Government's requirements for the planning system and how these are expected to be addressed.

Under Section 15; Conserving and Enhancing the Natural Environment, in Paragraph 174, the following is stated:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

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

Paragraph 185 of the document goes on to state:

"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"*

Paragraph 185 refers to the Noise Policy Statement for England, which is considered overleaf.

2 Ministry of Housing, Communities and Local Government (MHCLG), July 2021. National Planning Policy Framework. HMSO. London.

3.2 Noise Policy Statement for England, 2010

The underlying principles and aims of existing noise policy documents, legislation and guidance are clarified in DEFRA: 2010: Noise Policy Statement for England (NPSE) . The NPSE sets out the "*Long Term Vision*" of Government noise policy as follows:

"*Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development*".

The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- *"Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life".*

The guidance states that it is not possible to have a single objective noise-based measure that defines "*Significant Observed Adverse Effect Level (SOAEL)*" that is applicable to all sources of noise in all situations and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

3.3 National Planning Practice Guidance – Noise, 2019

The National Planning Practice Guidance (NPPG[3]) has been revised and updated to be easily accessible and available online.

The Noise Guidance advises on how planning can manage potential noise impacts in new developments. Paragraph: 002 of the PPGNoise states the following:

"Can noise override other planning concerns?

It can, where justified, although it is important to look at noise in the context of the wider characteristics of a development proposal, its likely users and its surroundings, as these can have an important effect on whether noise is likely to pose a concern."

As such, Paragraph: 003 of the NPPG states that:

3 National Planning Practice Guidance, Department for Communities and Local Government (DCLG), March

"Plan-making and decision making need to 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 the Explanatory note of the NPSE, this would include identifying whether the overall effect of the noise exposure … is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation."

Consequently, the National Planning Practice Guidance in England: Noise (NPPG Noise) summarises the noise exposure hierarchy, based on the likely average response. The following three observed effect levels are identified below, as identified in Paragraph 004:

- **Significant Observed Adverse Effect Level**: This is the level of noise exposure above which significant adverse effects on health and quality of life occur;
- **Lowest Observed Adverse Effect Level**: This is the level of noise exposure above which adverse effects on health and quality of life can be detected; and
- **No Observed Adverse Effect Level**: This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Importantly, Paragraph: 004 of the PPGNoise states that:

"Although the word 'level' is used here, this does not mean that the effects can only be defined in terms of a single value of noise exposure. In some circumstances adverse effects are defined in terms of a combination of more than one factor such as noise exposure, the number of occurrences of the noise in a given time period, the duration of the noise and the time of day the noise occurs."

Paragraph: 005 of the PPGNoise expands the significant criteria related to each of these levels, which are reproduced in Table 3.1.

Table 3.1: Significance Criteria from NPPG in England: Noise

Perception	Examples 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	No Observed Adverse Effect	No specific measures required

Table 3.1: Significance Criteria from NPPG in England: Noise			
Perception	**Examples of Outcomes**	**Increasing Effect Level**	**Action**
	not such that there is a perceived change in the quality of life.		
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; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported 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. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. 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	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an 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

4 Assessment Criteria

4.1 Commercial / Industrial Sound

The assessment of the sound impact of commercial sound from the Proposed Development should be made in accordance with BS4142:2014+A1:2019 *Method for Rating and Assessing Industrial and Commercial Sound*.

BS 4142 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS 4142 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ 'background sound level'.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

BS 4142 states: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs"*. An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- *"Typically, the greater this difference, the greater the magnitude of the impact."*
- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."*
- *"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."*

For the daytime, the assessment is typically carried out over a reference time period of 1-hour, but at night-time it is carried out over a 15-minute period. The periods associated with day or night, for the purposes of the Standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

4.2 Residential Amenity

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guidance values, as detailed below in Table 4.1.

Table 4.1: BS 8233:2014 Ambient Noise Levels			
Activity	**Location**	**07:00 to 23:00**	**23:00 to 07:00**
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.3 Relative Change in Ambient Noise Level

The IEMA Guidelines define 'Noise Impact' as the difference in the acoustic environment before and after the implementation of the proposals, also known as the magnitude of change. In circumstances where a noise environment may be altered by addition or removal of a noise source, considered to be largely anonymous or within the prevailing acoustic character of an area, for example, changes to traffic quantum or patterns, it is normal to consider this relative change in ambient noise level. The assessment, therefore, considers this phenomenon to add context.

The impact scale adopted in this assessment is shown in Table 4.2 below, which relates to established human responses to noise, in line with 'Table 7-12 Effect Descriptors' of the IEMA Guidelines and set in the context of NPPG.

Table 4.2: Impact scale for Comparison of Future Against Existing Noise			
Noise Level Change dB(A)	**Subjective Response**	**Significance**	**NPPG Context**
Less than 1.0	No perceptible	Negligible	NOEL
1.0 – 2.9	Barely perceptible	Minor impact	NOAEL
3.0 – 4.9	Noticeable	Moderate impact	LOAEL
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial impact	SOAEL
10.0 or more	More than a doubling or halving of loudness	Major impact	UAEL

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible

to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the perception of loudness. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

It is considered that the criteria specified in Table 4.2 provide a good indication as to the likely significance of changes in noise levels in this case and can be used to inform the context in which the sound occurs in order to assess the impact of noise from the proposed development.

5 Noise Measurements

The prevailing noise conditions in the area have been determined by an environmental noise survey conducted during both daytime and night-time periods between Thursday 8th and Friday 9th December 2021.

5.1 Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445[4].

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[5]. A full inventory of this equipment is shown in Table 5.1 below.

Table 5.1: Inventory of Acoustic Measurement Equipment

Item	Make & Model	Serial Number
A - Sound Level Meter	Rion NL-31	00110055
A - Preamplifier	Rion NH-21	00157
A - Microphone	Rion UC-53A	100648
Calibrator	Cirrus CR:515	72886

The noise measurement equipment used during the survey was calibrated at the start and end of the measurement. The calibrator used had itself been calibrated by a calibration laboratory within the twelve months preceding the measurements. No significant drift in calibration was found to have occurred on any sound level meter.

The weather conditions during the survey were suitable for environmental noise measurement; it being dry with very low wind speeds, below $5ms^{-1}$.

The microphone was fitted with a protective windshield for the measurement, which is described in greater detail below.

A measurement was carried out at a single location on the site, as described below and illustrated in Figure 5.1:

- Position 1 – A largely unattended measurement of background sound at a proxy location representative of the closest residential properties to the site, on Uxbridge Road. The measurement was undertaken under free-field conditions at a height of 1.5 metres above local

4 British Standard 7445: 2003: Description and measurement of environmental noise. BSI

5 British Standard 61672: 2013: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

ground level. The sound environment was entirely dominated by road traffic noise arising from vehicles using Uxbridge Road.

Figure 5.1: Noise Measurement Locations

The summarised results of the environmental noise measurements are presented in Table 5.2.

Table 5.2: Summary of Noise Measurement Results				
Position	**Period**	**Noise Level, dB**		
		$L_{Aeq,T}$	L_{A90}	L_{AFmax}
1	Day 07:00-23:00	65.2	62.0	89.1
	Night 23:00-07:00	62.4	54.0	82.6

6 Operational Noise Assessment

6.1 Noise Modelling

6.1.1 General

Given the speculative nature of the development and the requirement for end user fit out for the majority of M&E components, it is considered appropriate to complete the noise assessment on the basis of robust input statistics, based upon data provided by the Applicant's Transport Consultant and reasonable assumptions on internally generated noise and subsequent breakout.

Noise levels for external plant will be controlled by condition, with limits set within this report to apply at the nearest noise-sensitive receptor locations, as per the following suggested condition:

> *The rating sound level from fixed mechanical plant associated with the development shall not exceed a level of 10 dB below the typical background sound level when measured or calculated at the curtilage of the nearest noise-sensitive properties existing at the time of the approval of the planning permission, in accordance with the principles of BS 4142:2014+A1:2019.*

6.1.2 Source Data

Regarding vehicular activities at the site, archive sound source data have been used for the following activities. The sound parameters of sound exposure level (SEL) for each discreet manoeuvre are presented in Table 6.1.

Table 6.1: Summary of Sound Source Data for HGV Manoeuvres

Source	Measurement Distance (m)	Sound Exposure Level, SEL (dB)
HGV Passby	10	77.0
HGV Reversing (inc Reverse Alarm)	10	82.0
HGV Starting and Departing	10	76.0
Light Vehicle Passby	10	68.0

On the basis of the trip attraction statistics provided by the Applicant's Transport Consultant, the following peak usage scenarios have been considered:

- 10 HGVs and 23 light vehicles arriving and departing during a 1-hour daytime period; and
- 6 HGVs and 17 light vehicles arriving and departing during a 15-minute night-time period.

Noise breakout from the units associated with the Proposed Development has also been considered. It is very difficult to predict a meaningful internal reverberant sound pressure level due to the sporadic nature of the use of the equipment (i.e. the equipment and usage profile is unknown, as the tenants

for the industrial units area unknown), however warehousing is not considered to be an intrinsically noisy activity. Consequently, a peak activity, internal reverberant sound level of L_{Aeq} 70 dB, which is typical of many commercial and production environments, for context has been considered to represent a reasonable worst-case scenario.

In order to predict the sound breakout from the Proposed Development, a typical octave spectrum for a power tool, which tends to contain most of the sound energy above 1 kHz, has been adjusted to fit the broadband statistic. The spectral reverberant sound levels associated with the Proposed Development, based on the discussion above, can be seen below in Table 6.2.

Table 6.2: Sound Source Data

Source	Reverberant Sound Pressure Level, LpA (dB)	A-weighted Octave Band Sound Pressure Level, Hz (dB)							
		63	125	250	500	1k	2k	4k	8k
Industrial Unit	70	50	45	51	52	60	65	65	64

Furthermore, in order to calculate the sound reduction through the various façades and roof, the following sound reduction indices, as detailed in Table 6.3, have been used in the assessment.

Table 6.3: Sound Reduction Indices

Element	Sound Reduction Index, R, in Octave Bands, Hz (dB)							
	63	125	250	500	1k	2k	4k	8k
Kingspan KS1000 Standard Wall/Roof Panel	15	18	18	17	23	30	40	40
Roller Shutter Door	2	3	5	8	10	11	13	12

The impact on the composite sound reduction index from the doors associated with the Proposed Development has been assessed. It has been assumed that the roller shutter doors will be closed during operations.

The Standard Wall/Roof Panel is the Kingspan KS1000 product, which is a standard wall/roof insulated core panel used throughout industrial buildings in the UK.

The Roller Shutter Doors are bespoke items, as such, the Sound Reduction Indices outlined above for these items are a minimum specification for the supplier of these products, that must be achieved.

6.1.3 Calculation Process

Calculations were carried out using Cadna/A, which undertakes its calculations in accordance with guidance given in ISO9613-1:1993 and ISO9613-2:1996.

6.1.4 Sound Data Assumptions

Given that the land between proposed development and nearest receptors is largely hard and reflective, the ground factor has been set to 0.2 in the calculation software.

It has been assumed that all processes will occur simultaneously, representing a worst-case scenario.

6.1.5. Specific Sound Level Maps

The sound map showing the daytime specific sound level emissions from the Proposed Development can be seen in Figure 6.1 and Figure 6.2.

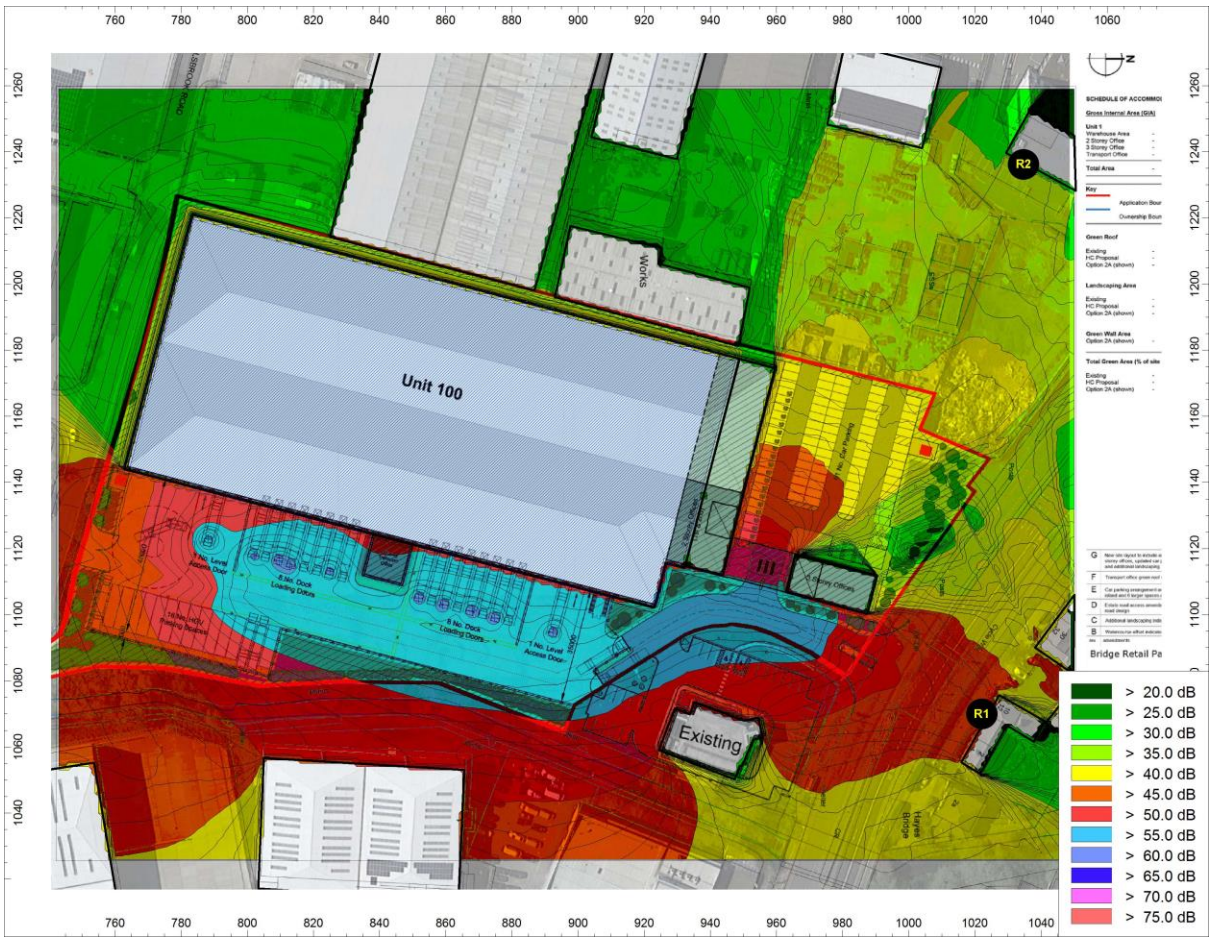

Figure 6.1: Daytime Specific Sound Level Map

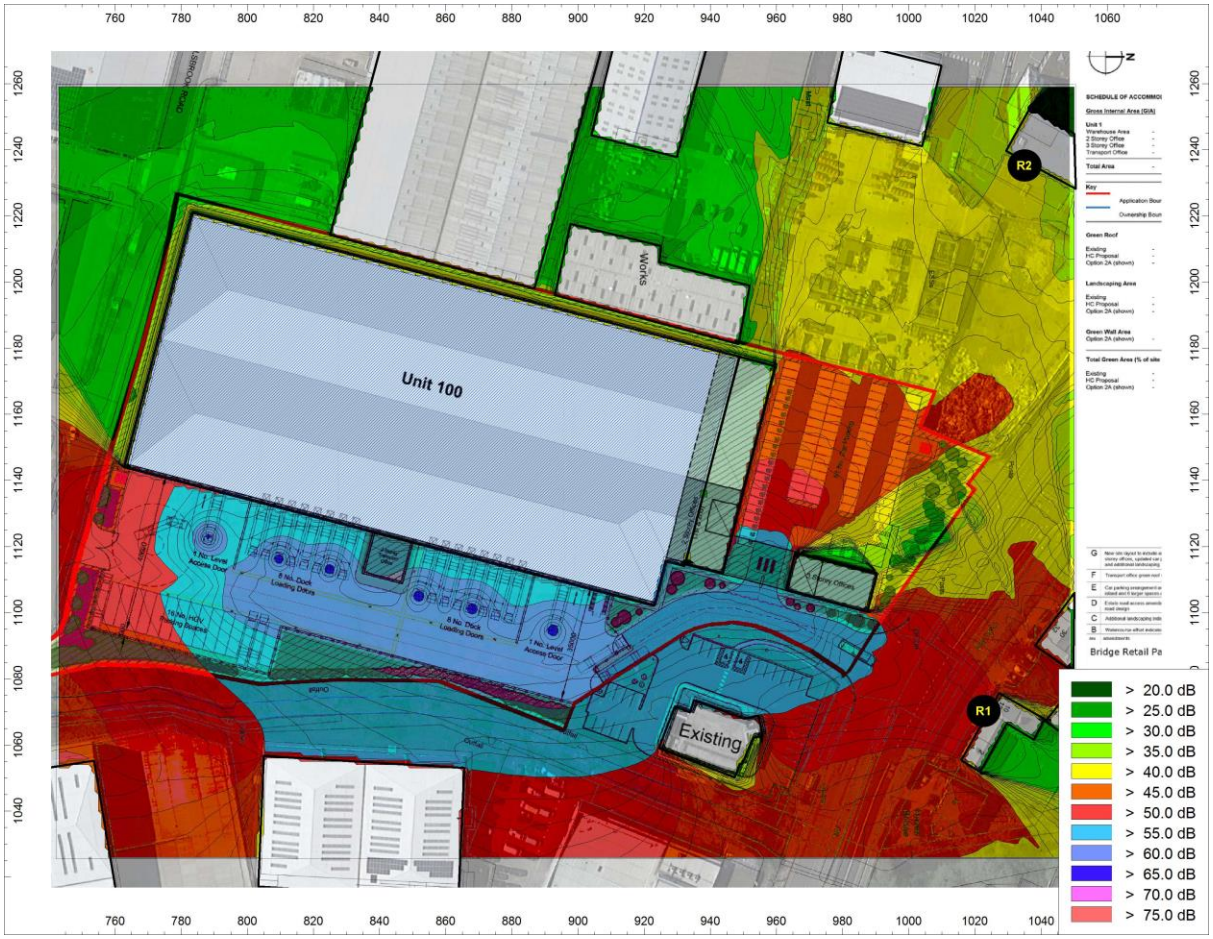

Figure 6.2: Night-time Specific Sound Level Map

6.1.6. Specific Sound Level Summary

A summary of the predicted specific sound levels at the NSRs, based on the sound map shown in Figure 6.1 and Figure 6.2 can be seen below in Table 6.4.

Table 6.4: Predicted Specific Sound Level Summary	
NSR	**Specific Sound Level (dB)**
Daytime	
R1 – 6 Uxbridge Road	45.8
R2 – Top Floor of Hyatt Place (Hotel)	35.1
Night-time	
R1 – 6 Uxbridge Road	49.8
R2 – Top Floor of Hyatt Place (Hotel)	39.0

6.2 Assessment

6.2.1. Rating Penalty Principle

Section 9 of BS4142 describes how the rating sound level should be derived from the specific sound level, by determining a rating penalty.

BS4142 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;

b) objective method for tonality;

c) reference method."

Given that the Proposed Development is not operational, the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

Tonality

A rating penalty of +2 dB is applicable for a tone which is "*just perceptible*", +4 dB where a tone is "*clearly perceptible*", and +6 dB where a tone is "*highly perceptible*".

Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is *"just perceptible"*, +6 dB where it is *"clearly perceptible"*, and +9 dB where it is *"highly perceptible"*.

Intermittency

BS4142 states that when the *"specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time … if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."*

Other Sound Characteristics

BS4142 states that where *"the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."*

6.2.2. Rating Penalty Assessment

Considering the above, an assessment of the various sound sources associated with the Proposed Development, in terms of whether any rating penalties are applicable, has been detailed in Table 6.5 below.

Table 6.5: Rating Penalty Assessment

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
HGV Movements	0 dB	0 dB	0 dB	0 dB	The HGVs will operate as required. No corrections are applicable, as HGV movements are not outwith the character of the area, especially considering the proximity of the local and regional road network.
Internal Activities	0 dB	0 dB	0 dB	0 dB	The predicted specific sound level is below the background sound level, therefore the perceptibility is likely to be low, hence no further corrections for tonality, impulsivity and intermittency.

In summary, a rating penalty of 0 dB has been included in the assessment.

6.2.3. Uncertainty in Calculations

BS4142 requires that the level of uncertainty in the measured data and associated calculations is considered in the assessment. The Standard recommends that steps should be taken to reduce the level of uncertainty.

Measurement Uncertainty

BS4142 states that measurement uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

" *…*

b) the complexity and level of variability of the residual acoustic environment;
…
d) the location(s) selected for taking the measurements;
…
g) the measurement time intervals;
h) the range of times when the measurements have been taken;
i) the range of suitable weather conditions during which measurements have been taken;
...
k) the level of rounding of each measurement recorded; and
l) the instrumentation used."

Each of the measurement uncertainty factors outlined above have been considered and discussed in Table 6.6 below.

Table 6.6: Measurement Uncertainty Factors

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Residual acoustic environment is relatively constant, hence no correction for a complex residual acoustic environment.
d)	0 dB	The measurements were undertaken at a location considered to be robustly representative of the closest noise-sensitive receptors to the site..
g)	0 dB	Measurement time intervals were set in accordance with BS4142:2014+A1:2019, hence no further correction needs to be made.
h)	0 dB	Measurements were undertaken over a continuous 24-hour period.
i)	0 dB	The weather conditions throughout the survey were calm and dry.
k)	0 dB	Measured values were rounded to 0.1 dB, therefore rounding would not have had a significant impact on the overall typical background sound levels.
l)	0 dB	The acoustic measurement equipment accorded with Type 1 specification of British Standard 61672, and were deployed with appropriate wind shields.

In summary, no uncertainty budget has been considered in the assessment, to account for measurement uncertainty.

Calculation Uncertainty

BS4142 states that calculation uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

> *"* …
>
> *b) uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels;*
> *c) uncertainty in the calculation method;*
> *d) simplifying the real situation to "fit" the model (user influence on modelling); and*
> *e) error in the calculation process."*

Each of the calculation uncertainty factors outlined above have been considered and discussed in Table 6.7 below.

Table 6.7: Calculation Uncertainty Factors

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Sound levels for all sources/activities have been based on robust archive data and reasonable worst-case assumptions.
c)	0 dB	Calculations were undertaken in accordance with ISO 9613-2, which is considered a "validated method" by BS4142.
d)	0 dB	The real situation has not been simplified for the purposes of this assessment.
e)	±1 dB	ISO 9613-2 indicates that there is a ±3 dB accuracy to the prediction method, therefore, an uncertainty factor of ±1 dB is considered appropriate and proportional, given the separation distances involved.

In summary, an uncertainty budget of ±1 dB has been considered in the assessment, to account for calculation uncertainty.

The overall uncertainty is considered to be small enough that it would not affect the conclusions of the assessment.

6.2.4. BS4142 Assessment

The rating sound level, as calculated from the predicted specific sound level, has been assessed in accordance with BS4142, at the closest residential NSR to the site.

The BS4142 assessment at the closest NSR, during the daytime period, can be seen in Table 6.8.

Table 6.8: Daytime BS4142 Assessment			
NSR	**Rating Sound Level (dB)**	**Daytime Background Sound Level (dB)**	**Excess of Rating over Daytime Background Sound Level (dB)**
1	46	62	-16

The assessment in accordance with BS4142 indicates that the proposed development will have a *"Low Impact"* at the nearest noise-sensitive receptors during the daytime period, indicating that proposed development falls within the NOAEL range.

The BS4142 assessment at the closest NSRs, during the night-time period (06:00-07:00), can be seen in Table 6.9.

Table 6.9: Night-time BS4142 Assessment			
NSR	**Rating Sound Level (dB)**	**Night-time Background Sound Level (dB)**	**Excess of Rating over Daytime Background Sound Level (dB)**
1	50	54	-4

The assessment in accordance with BS4142 indicates that the proposed development will have a *"Low Impact"* at the nearest noise-sensitive receptors during the night-time period, indicating that proposed development falls within the NOAEL range.

6.2.5. Internal Amenity Assessment Hotel

The predicted noise levels at the Hyatt Place Hotel are substantially below the prevailing ambient sound level in the area and, in isolation, would comfortably achieve the BS8233 internal amenity criteria with windows open for ventilation.

The predicted levels, coupled to the suggested planning controls for static plant will ensure that the Proposed Development will have no impact upon the hotel.

6.2.5. Discussion

The assessment set out in Tables 6.8 and 6.9 identify that the development can operate during the daytime and night-time periods without giving rise to adverse noise effects at the closest NSRs to the site.

It is therefore suggested that on the basis of accepting the operating restrictions suggested in this report, that noise should not present an impediment to the approval of planning permission for the proposals, as they stand.

7 Conclusion

Kairus Ltd has been commissioned to assess the impact of noise associated with a speculative commercial development at Bridgwater Retail Park, Hayes.

The assessment has been based on detailed environmental noise measurements at the site and a subsequent predictive exercise.

This assessment has considered all noise sources having the potential to influence the amenity of the adjacent receptor locations and has concluded that the site is predicted to give rise to a *low impact*, equating to an impact in PPG England terms of *No Observed Adverse Effect Level* (NOAEL).

Considering the above, it is recommended that noise should not be a constraint to the approval of this Planning Application.

Appendix A - Acoustic Terminology

Table A1.1 – Glossary of Acoustic Terminology	
Term	**Definition**
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1.2 - Typical Sound Levels Found in the Environment	
Sound Level	**Location**
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Appendix B - Full Noise Measurement Results

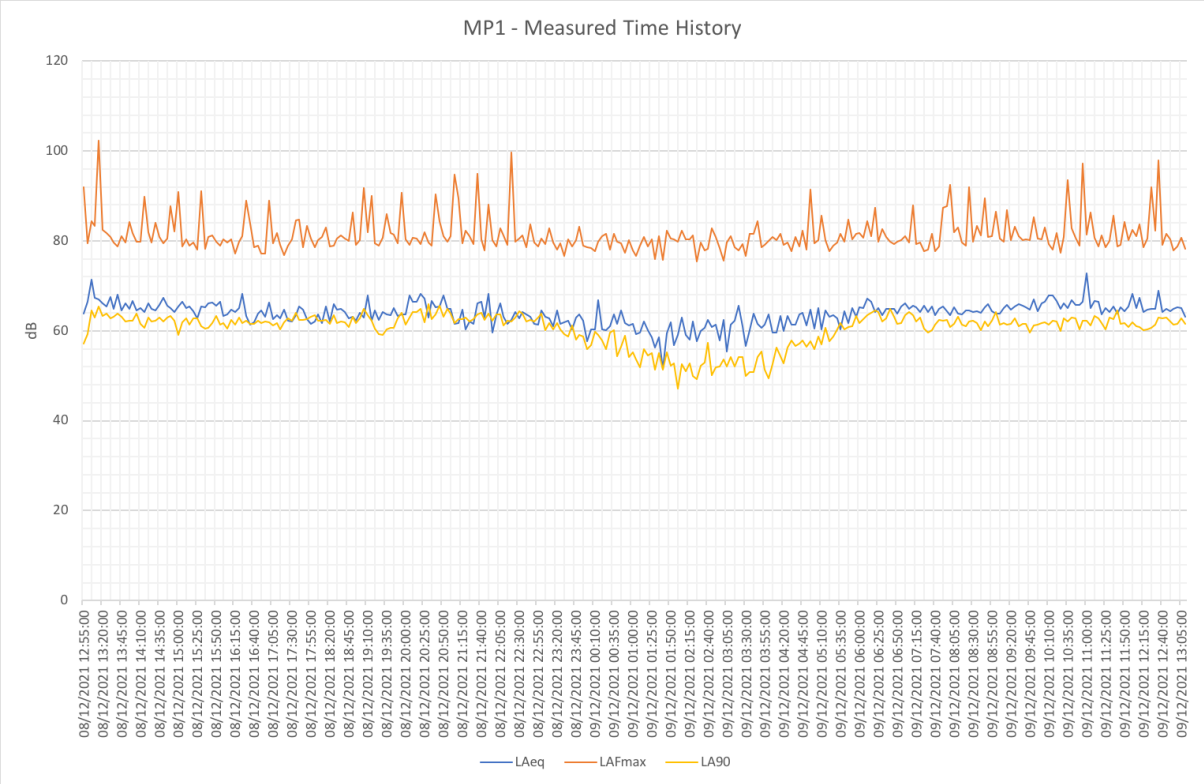

Chart 1: Measured Time History

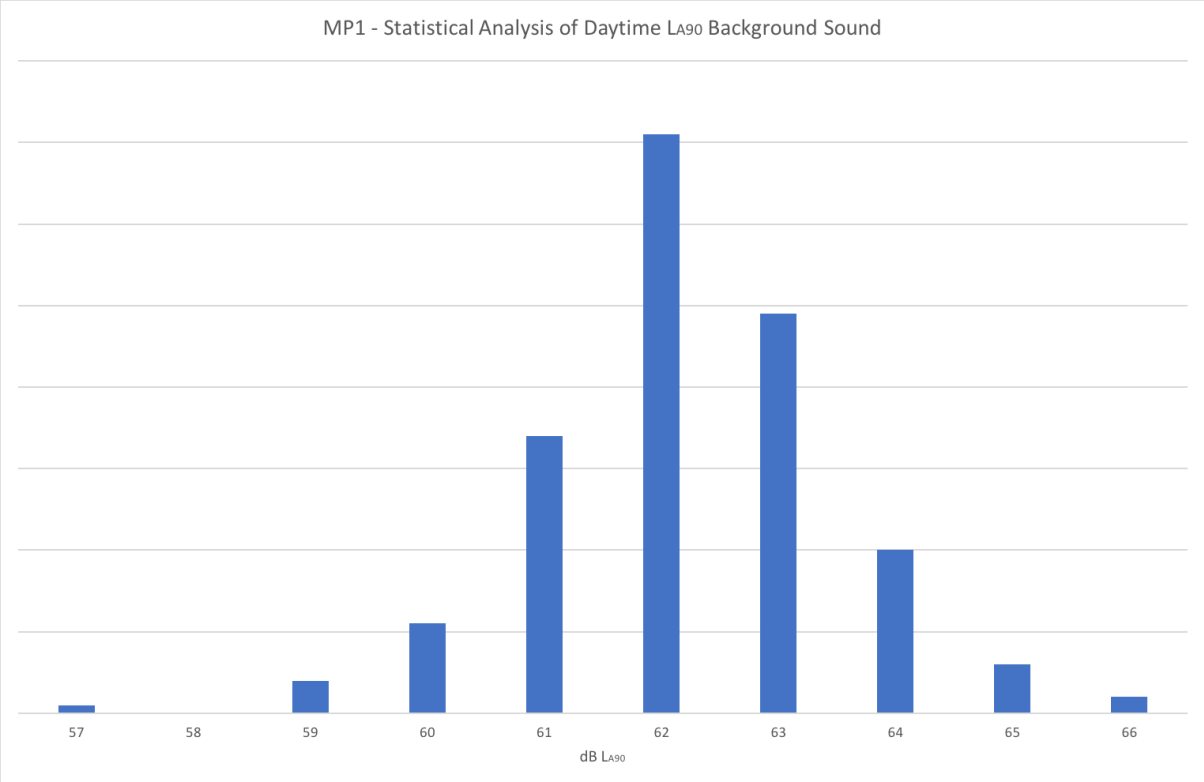

Chart 2: Statistical Analysis of Daytime Background Sound

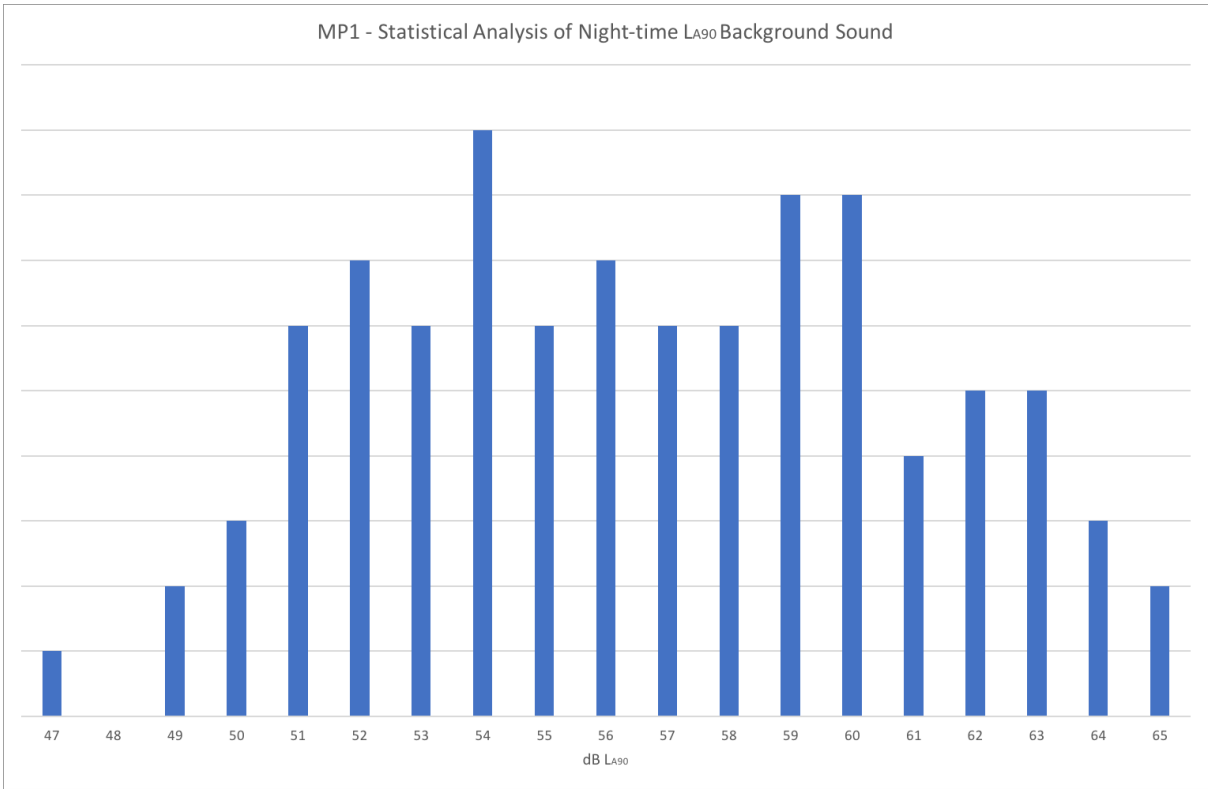

Chart 3: Statistical Analysis of Night-time Background Sound