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Units H, I, J, K, L, M, N Hornbeam Road North Walsham

Noise Impact Assessment Report
Report 19793.NIA.02

Birchwood Building
Vale Road
High Kelling
Holt
Norfolk NR25 6RA

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KP Acoustics Ltd. 2021

Contents

List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by Birchwood, Vale Road, High Kelling, Holt, Norfolk, NR25 6RA, to undertake a noise assessment for 7 No. B2/B8 industrial units located at Hornbeam Road, North Walsham. It should be noted that the units under assessment are proposed as Phase 4 of the Hornbeam Business Park Development, which covers Units H, I, J, K, L, M & N.

A 24 hour environmental noise survey has been undertaken on site in order to prepare a noise impact assessment in accordance with BS4142:2014 '*Method for rating and assessing industrial and commercial sound'*.

This report presents the methodology and results from the environmental survey, followed by calculations in accordance with BS4142 to provide an indication as to the likelihood of the noise emissions from worst-case B2 use (general industrial) having an adverse impact on the closest noise sensitive receiver. Mitigation measures will be outlined as appropriate.

2.0 SITE SURVEYS

2.1 Site Description

As shown in Figure 2.1, the site is bounded by Hornbeam Road to the West and North Walsham Railway Station and railway lines to the East.

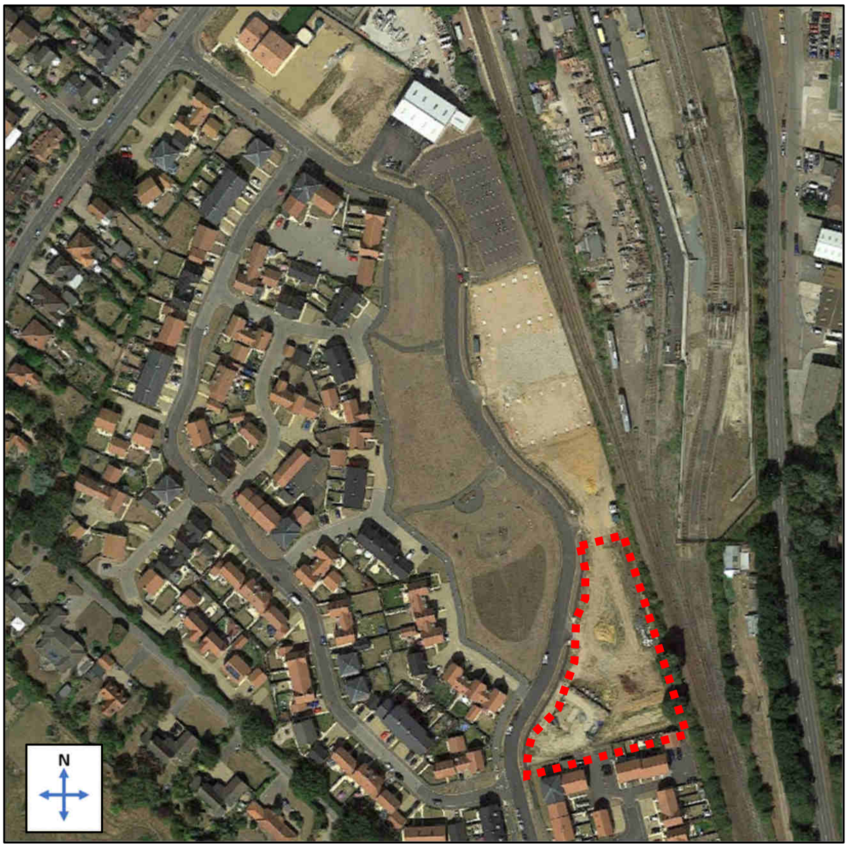


Figure 2.1 Site location plan (Image Source: Google Maps)

Initial inspection of the site revealed that the background noise profile at the monitoring location was comprised of road traffic noise from the surrounding roads, as well as sporadic noise from the nearby railway line.

2.2 Environmental Noise Survey Procedure

Continuous automated monitoring was undertaken for the duration of the noise surveys between 13:14 on 17/01/2020 and 04:12 on 20/01/2020 at the location detailed in Table 3.1 and shown in Figure 2.2.

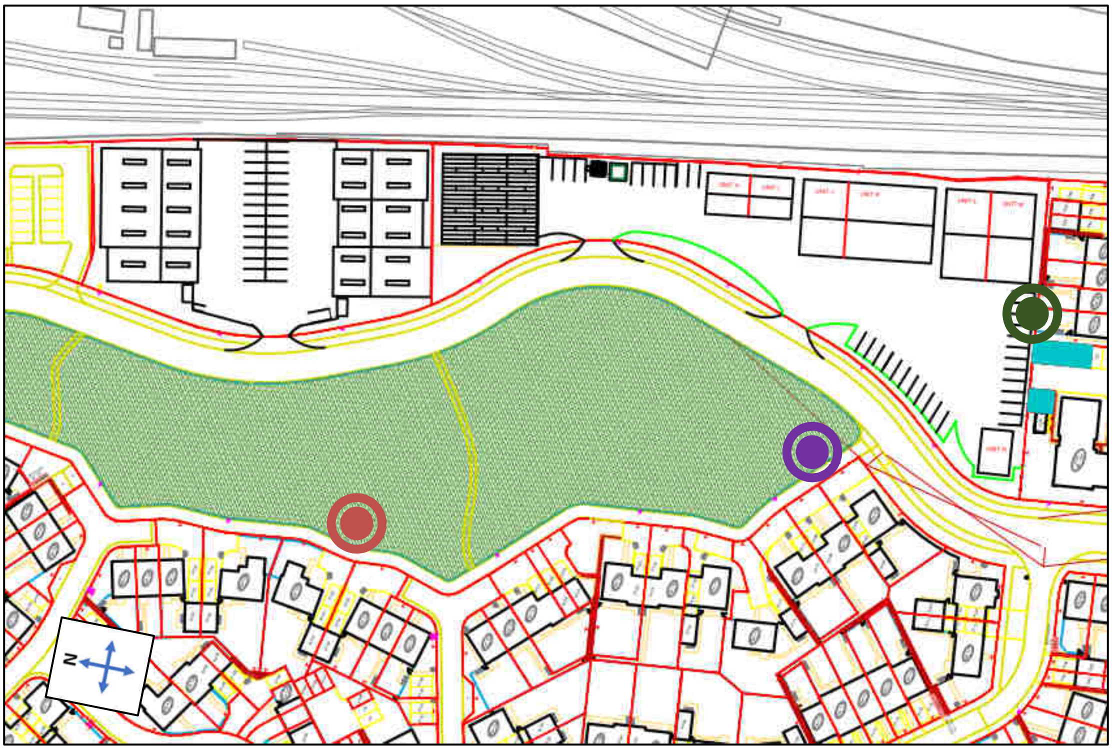


Figure 2.2 Site location plan including noise monitoring positions and closest receivers

Icon	Descriptor	Location Description
	Noise Measurement Position 1	The microphone was installed on a tripod at a height of 1.2m above ground, as shown in Figure 2.1
	Noise Measurement Position 2	The microphone was installed on a tripod at a height of 1.2m above ground, as shown in Figure 2.1
	Noise Measurement Position 3	The microphone was installed at the top of a fence post within the southern part of the Hornbeam Business Park Estate, at a height of approximately 2.2m above ground, as shown in Figure 2.1

Table 2.1 Measurement position and description

The choice of the positions was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receivers relative to the proposed units.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2007 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

Measurement instrumentation		Serial no.	Date	Cert no.
Noise Kit 8	Svantek Type 958A Class 1 Sound Level Meter	59559	26/09/2019	14012947
	MTG MK250 Free-field microphone	10904		
	Preamp Svantek SV12L	33619		
	Svantek External windshield	-	-	-
Noise Kit 9	Svantek Type 958A Class 1 Sound Level Meter	45578	04/07/2018	14009933
	Free-field microphone PCB 377B02	169770		
	Preamp PCB 426E01	128280		
	Svantek External windshield	-	-	-
Noise & Vibration Kit 1	Svantek Type 958A Class 1 Sound Level Meter	45579	20/08/2018	14010338
	Free-field microphone MTG MK255	11697		
	Preamp Svantek SV12L	41535		
	Svantek External windshield	-	-	-
B&K Type 4231 Class 1 Calibrator		2147411	04/02/2019	04130/1

Table 2.2 Measurement instrumentation

3.0 RESULTS

3.1 Environmental Noise Survey

The $L_{Aeq:\ 5min}$, $L_{Amax:\ 5min}$, $L_{A10:\ 5min}$ and $L_{A90:\ 5min}$ acoustic parameters were measured throughout the duration of the surveys. Measured levels are shown as a time histories in Figures 19793.TH1-3 for noise monitoring positions 1-3 respectively.

Average ambient noise levels and representative background noise levels are shown in Table 3.1. Representative background noise level has been derived from the most commonly occurring $L_{A90,5\ min}$ levels measured during the environmental noise survey undertaken on site, as shown in 19793.LA90-1, 19793.LA90-2 and 19793.LA90-3 for noise monitoring positions 1-3 respectively.

It should be noted that the periods indicated on the time history have been removed for the purpose of calculating average noise levels, to ensure construction activity on site does not compromise the results.

Monitoring Position	Time Period	Average Ambient Noise Level $L_{Aeq,\ T}$ dB(A)	Representative background noise level L_{A90} dB(A)
1	Daytime (07:00-23:00)	48	40
	Night-time (23:00-07:00)	43	24
2	Daytime (07:00-23:00)	52	46
	Night-time (23:00-07:00)	41	30
3	Daytime (07:00-23:00)	49	46
	Night-time (23:00-07:00)	40	30

Table 3.1 Ambient and representative background noise levels

4.0 PROPOSED UNIT CONSTRUCTION

Units H, I, J, K, L, M & N are outlined in Figure 4.1 below, which are covered by this noise impact assessment.

Figure 4.2 Proposed layout of industrial units H, I, J, K, L, M & N

The units will be constructed from Kingspan KS1000 RW Ecosafe panels, which provide a sound reduction values shown in Table 4.1.

Unit	Sound Reduction Index in each Octave Frequency Band (Hz)								R_w dB
	63	125	250	500	1k	2k	4k	8k	
Kingspan KS1000	20	18	20	24	20	29	39	47	25

Table 4.1 Sound reduction index of proposed external building fabric element

5.0 CLOSEST NOISE SENSITIVE RECEIVERS

The closest noise sensitive receivers the industrial units are shown in Figure 5.1. Closest direct distances from source to receivers are also shown.

3 No. receiver dwellings have been identified as the closest to particular units. In order to provide a robust assessment, breakout noise from all units which this phase will be assessed to each receiver noted in Figure 5.1.

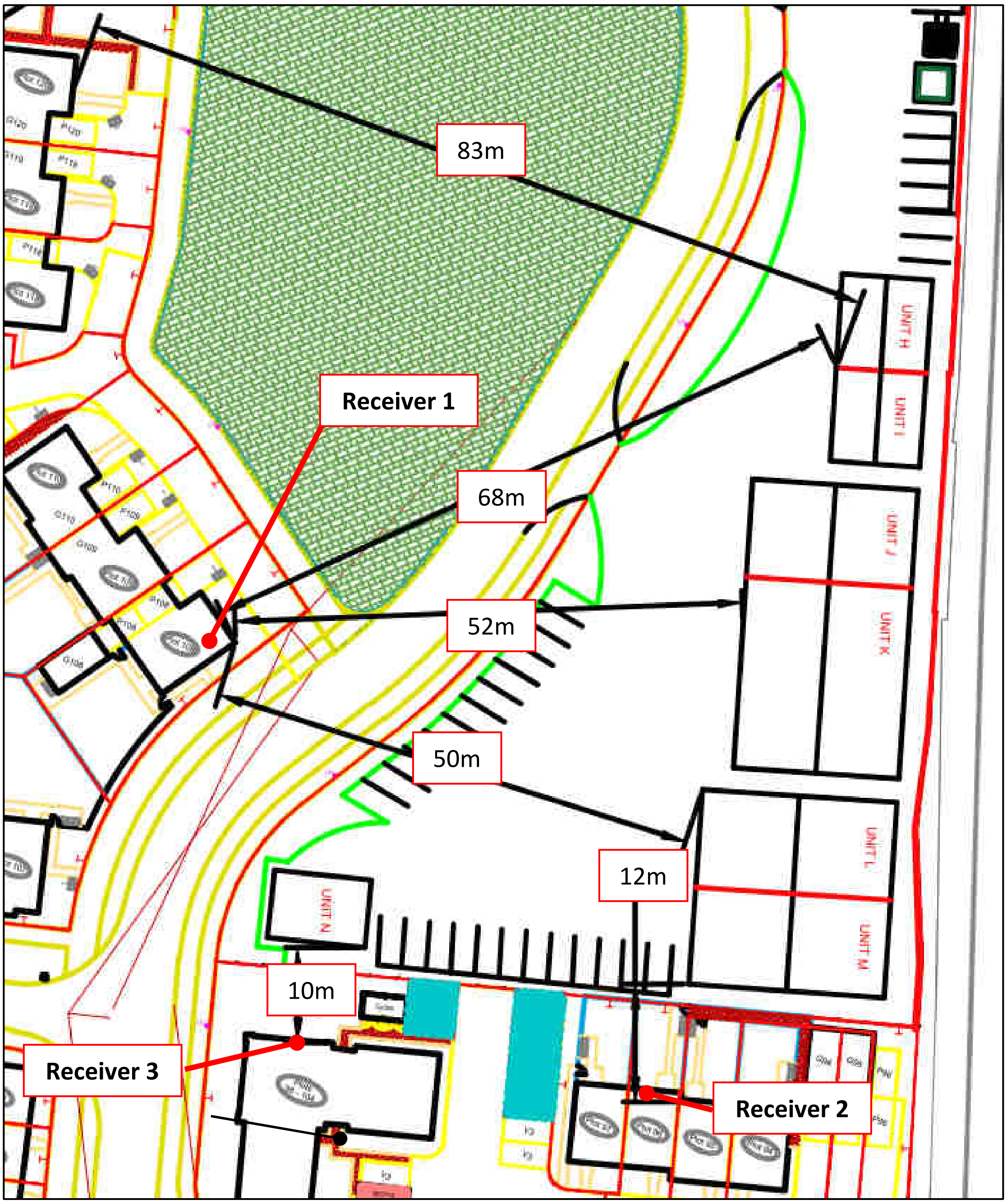


Figure 5.1 Proposed industrial units in relation to closest noise sensitive receivers

6.0 NOISE ASSESSMENT METHODOLOGY

It is understood that the proposed units will be B2 (general industrial) or B8 (storage and distribution) use.

For the previous units within the scheme, the Local Authority has requested that a noise impact assessment is prepared and has provided the following guidance:

Noise Impact Assessment

Noise sensitive uses would include schools, hospitals, care facilities, residential uses, libraries, passive recreation uses and places of worship.

Noise generating uses would include drinking establishments, heavily trafficked roads, theatres, night clubs, industrial uses, assembly and leisure uses as well as farm complexes.

The interpretation of close proximity will include properties adjacent to the site and within a reasonable proximity. However, depending on the particular circumstances, a wider area may need to be included. For example, in areas of open countryside or where night-time/daytime background noise levels are particularly low and/or where a noise generating use is likely to have wider implications.

Noise assessments which fall in to either of the two categories should be carried out by a qualified professional.

Required for:

a) any application proposing noise sensitive uses within close proximity to existing noise generating uses (or those with an extant permission);

b) any application proposing noise generating development (this includes uses, plant, machinery or equipment) within close proximity to noise sensitive uses.

In the case of this scheme, the proposal involves the introduction of a new noise generating units within close proximity to residential receivers located on Hornbeam Road.

As the future occupiers of the units are currently unknown and therefore the noise emissions of the units are unknown, we would propose to undertake a noise assessment in accordance with British Standard BS4142:2014 '*Methods for rating and assessing industrial and commercial sound*' assuming a worst-case scenario of a metal working workshop (B2 use).

Metal workshops would have a number of machines for various processes which would be used within the unit, such as:

- Forming processes (bulk and sheet forming)
- Cutting processes (milling, turning, threading, grinding, filing, etc)
- Joining processes (welding, brazing, soldering, riveting, etc)
- Other processes such as heat treatment, plating, thermal spraying, etc

In order to associate realistic noise levels of the various machines and operations for metalworking, $L_{Aeq, 8 hour}$ noise data would be used from a noise at work assessment undertaken at a metalworking workshop previously undertaken by KP Acoustics.

This noise at work assessment was undertaken using the Casella CEL-350 noise dosimeter mounted on the shoulder of 6 No. operators. This noise data would be considered worst case as the microphone was positioned in close proximity to the machines under use, rather than within the room at a given distance from the machine.

Noise data from 6 No. operators within the metalworking unit are shown in Table 6.1, with the highest being used for this assessment. Graphical data of the measured levels are shown in Appendix B.

Staff Member	Noise Level $L_{Aeq, 8 hour}$
1	90 dB(A)
2	88 dB(A)
3	90 dB(A)
4	91 dB(A)
5	91 dB(A)
6	91 dB(A)

Table 6.1 Overall measured $L_{Aeq, 8 hr}$ dose levels for staff members at metalworking facility

Using the above noise data and the sound reduction of the proposed external building fabric, calculations would be undertaken in order to predict the expected noise level at 1 metre from the window of the closest noise sensitive receiver.

7.0 NOISE ASSESSMENT GUIDANCE

7.1 BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound'*

British Standard BS4142:2014 '*Methods for rating and assessing industrial and commercial sound*' describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes:

- Sound from industrial and manufacturing processes
- Sound from fixed installations which comprise mechanical and electrical plant and equipment
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

This Standard compares the Rating Level due to the noise source/s under assessment for a one-hour period during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours) with the existing background noise level in terms of an L_{A90} when the noise source is not operating.

It should be noted that the Rating Level is the Specific Sound Level in question ($L_{Aeq,\ Tr}$), including any relevant acoustic feature corrections, as follows:

- **Tonality** – '*For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible'*
- **Impulsivity** – '*A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible'*
- **Intermittency** – '*If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied'*

- **Other sound characteristics** – '*Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied*'

Once the Rating Level has been obtained, the representative background sound level is subtracted from the Rating Level to obtain an initial estimate of the impact, as follows:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5 dB could 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 there will be an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context

NOTE: Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

8.0 BS4142 ASSESSMENT

Source noise levels used for this assessment are as detailed in Section 6.0. The closest noise sensitive receivers to the proposed industrial units are as detailed in Section 5.0.

Although the exact operating hours of the units are currently unknown, it is assumed that they would not operate outside of daytime hours (07:00-23:00), and it is assumed that this would be conditioned by the Local Planning Authority.

Noise breakout calculations have been undertaken for all units (H, I, J, K, L, M & N) to each of the 3 No. receiver locations outlined in Figure 5.1, in order to cater for a worst-case scenario.

The lowest representative background noise level of 40dB(A), measured across the 3 No. monitoring positions, will be used for all receiver locations to provide a robust assessment.

8.1 Calculations

The 'Specific Sound Level' generated from each industrial building has been calculated at 1m from the identified closest receiver façades and corrected due to the various internal acoustic feature corrections, as well as external propagation factors.

The main acoustic model was designed around the following formula:

$$SPL2 = SPL1 - SRI + 10\log(S) + 20\log(r) - 14$$

where:

SPL2 is the sound pressure level at the receiver's facade

SPL1 is the sound pressure level within the source room

S is the area of the main wall

r is the distance correction

SRI is the sound reduction index of the break-out facade

The 14dB term occurs due to no reverberant sound field in the open (6dB) plus the propagation effect of the wall ($10\log(2/4\pi 1^2)=8dB$)

The 'Rating Level' of the operations within each industrial unit have been assessed following the guidelines of BS4142 for the daytime period.

Detailed calculations are shown in Appendices C1-C3 for Receivers 1-3 respectively.

Receiver	Representative Background Noise Level During Daytime	Specific Noise Level at 1m From Receiver Façade	Rating Noise Level at 1m From Receiver Façade as Proposed	Rating Noise Level at 1m From Receiver Façade with Additional Upgrades to the External Building Fabric
Receiver 1	40dB(A)	44dB(A)	52dB(A)	27dB(A)
Receiver 2	40dB(A)	42dB(A)	50dB(A)	25dB(A)
Receiver 3	40dB(A)	46dB(A)	54dB(A)	29dB(A)

Table 8.1 BS4142 assessment

As shown in Appendices C1-C3 and Table 8.1, transmission of breakout noise to the nearest sensitive windows from the industrial units would be above the representative background noise level during daytime hours with the currently proposed Kingspan KS1000 insulated panel system.

In order to ensure that the amenity of the closest residential receivers is protected, we would recommend that the external building fabric is upgraded as detailed in Section 9, which would result in Rating Noise Levels at the receivers in the range of 25-29dB(A). Such Rating Levels would be significantly below the representative background noise level and would ensure that the amenity of the surrounding residents is not compromised.

Please note that the upgrades detailed in Section 9.0 would only be applicable for B2 use. It should be noted that if any of the units operate as B8 use, the upgraded external building fabric would not be required as internal noise levels generated would be significantly lower (by at least 20dB) than those used within this assessment. An example of this would be Screwfix who are currently operating at Unit A.

9.0 PROPOSED UPGRADE TO THE EXTERNAL BUILDING FABRIC

As outlined in Section 4.0 and Table 4.1, the proposed Kingspan KS1000 panel system would provide an overall sound reduction of 25dB R_w.

In order for a higher level of sound insulation to be provided, we would recommend that the external walls are upgraded as follows:

- 70mm metal 'C' studs (or timber studs) installed at a distance of 10-20mm from the Kingspan panel system
- 50mm mineral wool insulation (density 45kg/m^3) installed between the studs
- 2x12.5mm plasterboard installed as a new internal wall lining

The above construction has been simulated in sound insulation prediction software Insul and would be expected to provide a sound reduction of 50dB R_w. The Insul simulation has been attached as an Appendix to this document.

10.0 CONCLUSION

An environmental noise survey and BS4142 assessment have been carried out for the proposed industrial units at Hornbeam Road, North Walsham.

The calculations have allowed the likelihood of any adverse impact upon nearby future residents of the adjacent residential development site to be predicted.

Calculations have shown that noise breakout from the industrial units considering a worst case B2 use would be indicative of a low likelihood of adverse impact on nearby receivers, providing that the mitigation measures outlined in Section 9.0 are implemented.

The units could operate as B8 use without the requirement of further mitigation.

Hornbeam Business Park, North Walsham
Environmental Noise Time History
From 17 January 2020 To 20 January 2020

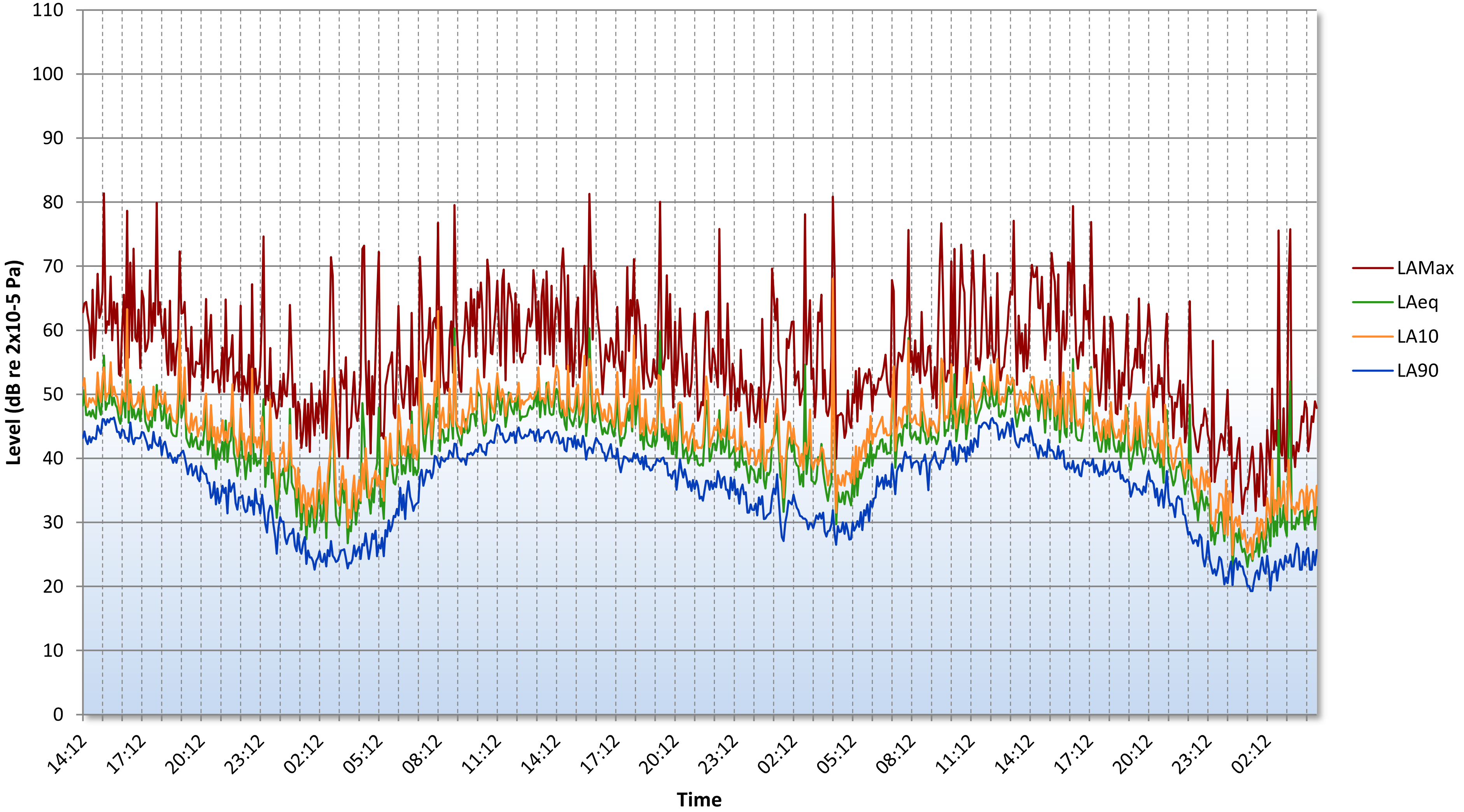


Figure 19793.TH1

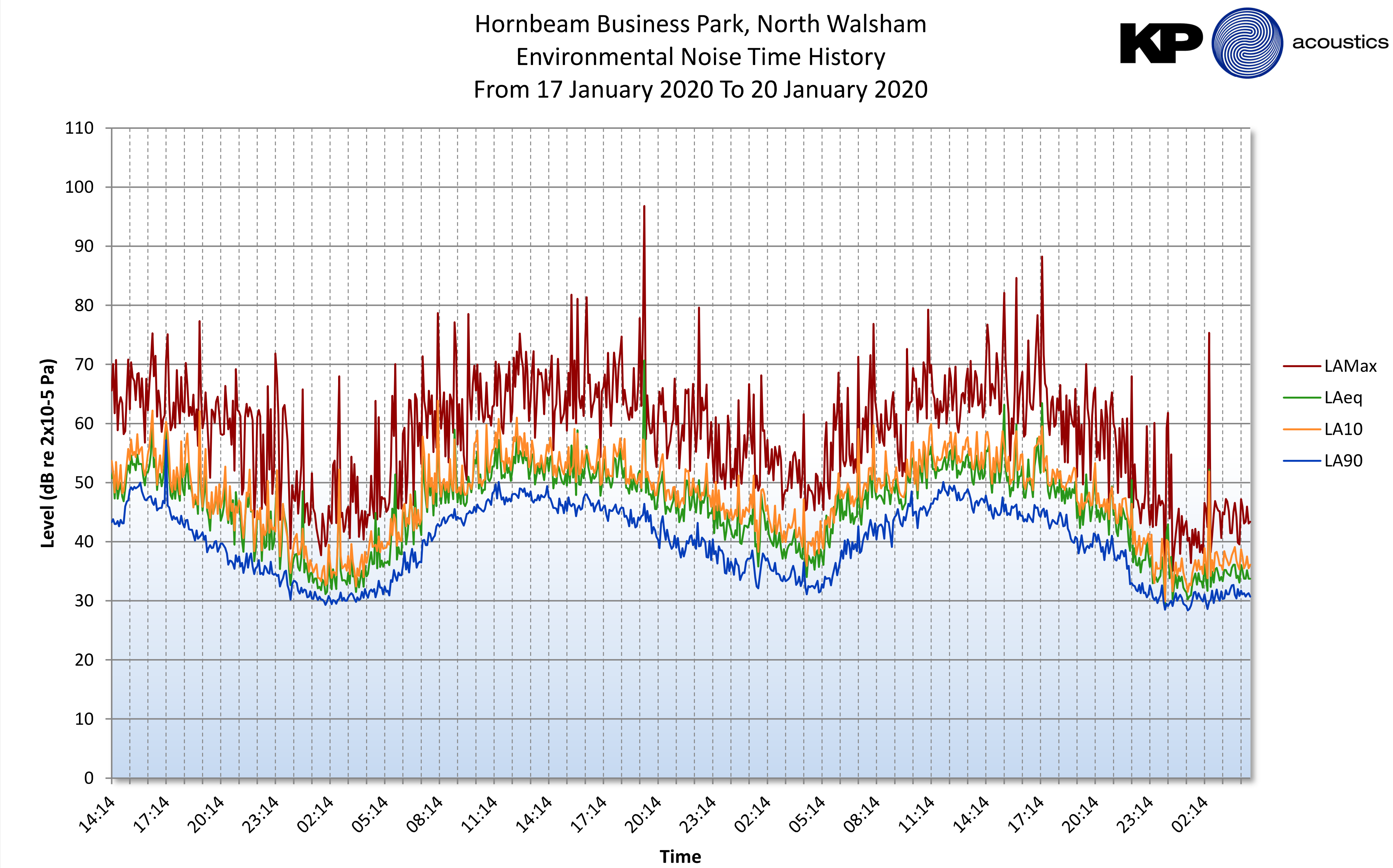


Figure 19793.TH2

Hornbeam Business Park, North Walsham
Environmental Noise Time History
From 17 January 2020 To 20 January 2020

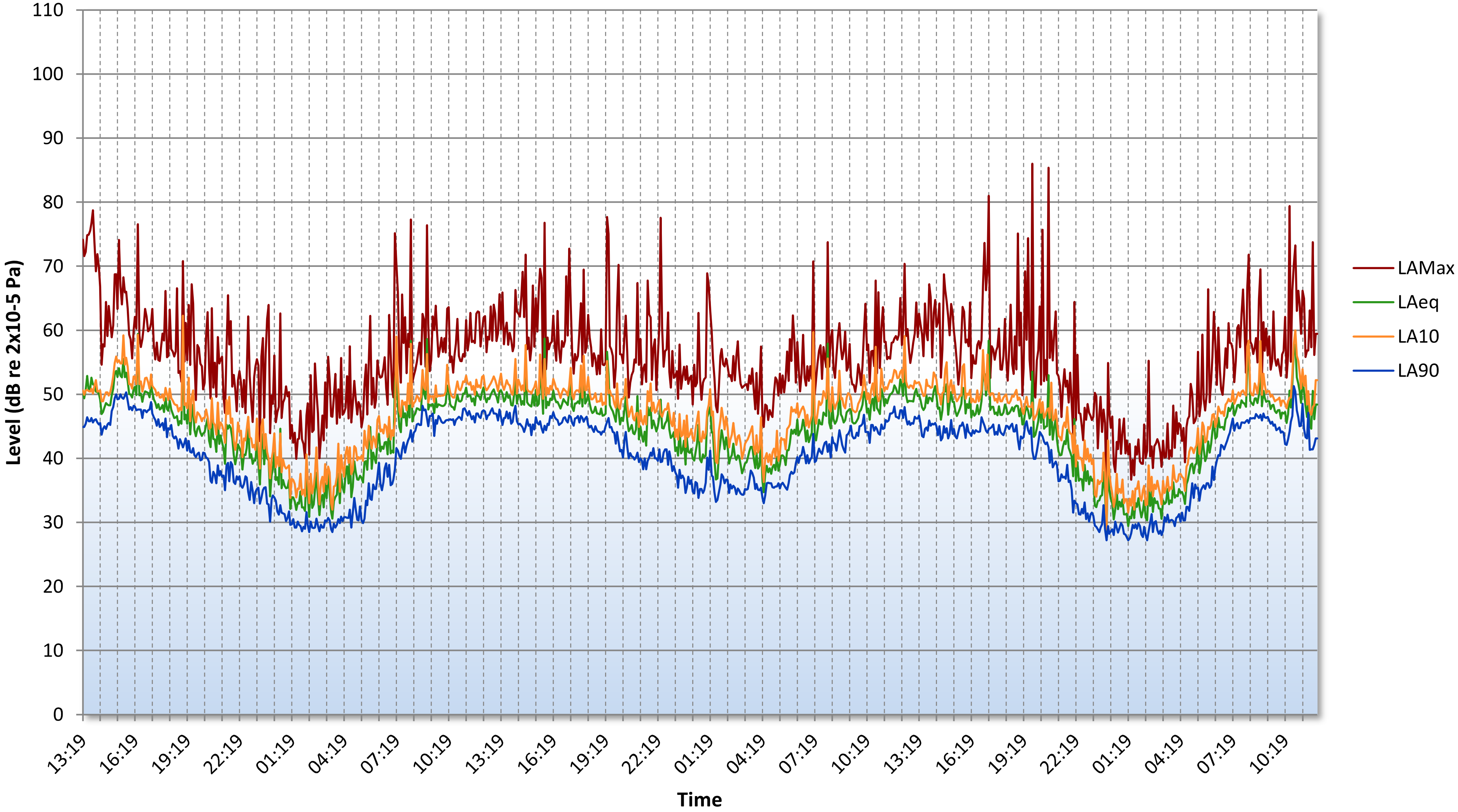


Figure 19793.TH3

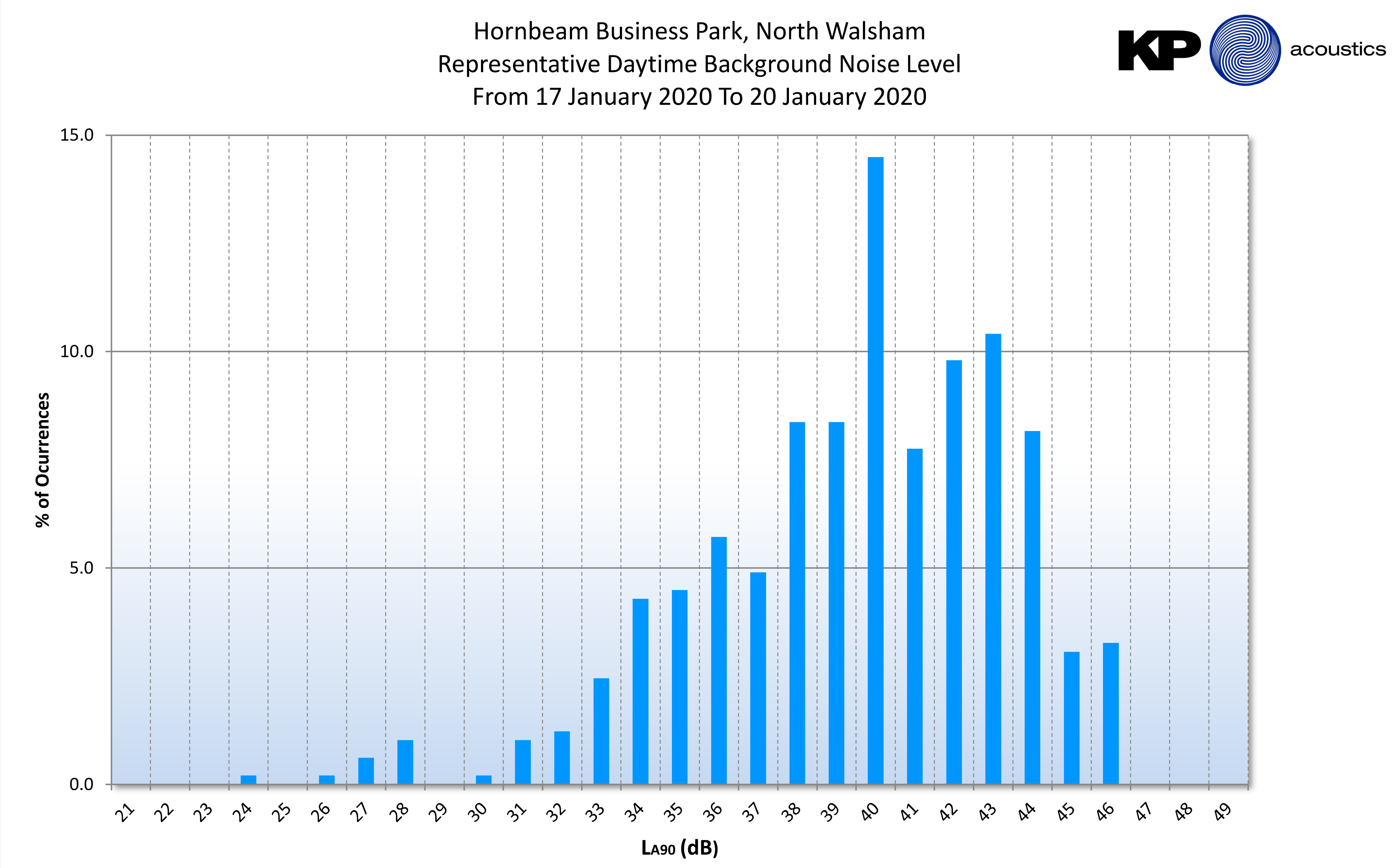


Figure 19793.L90-1

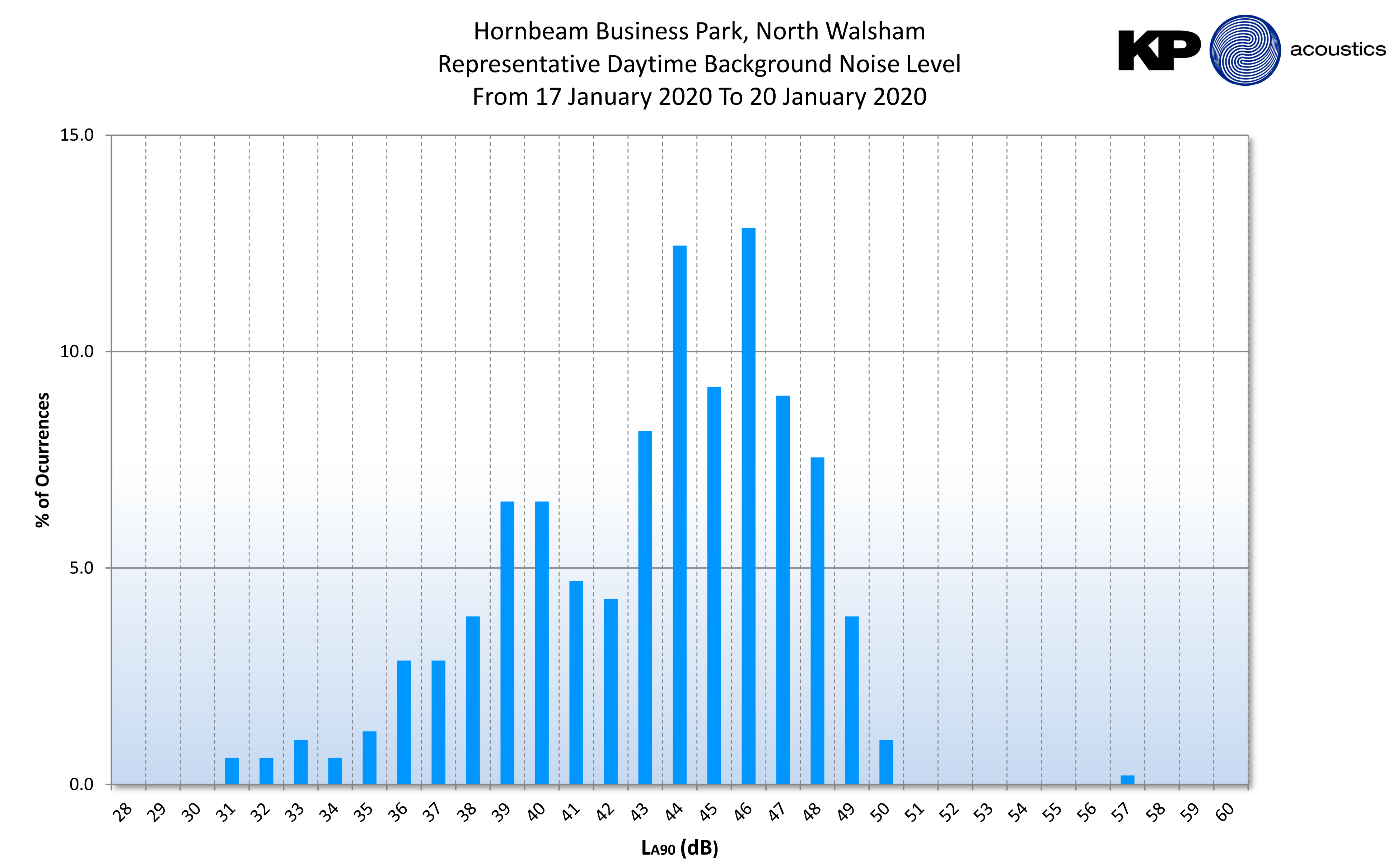


Figure 19793.L90-2

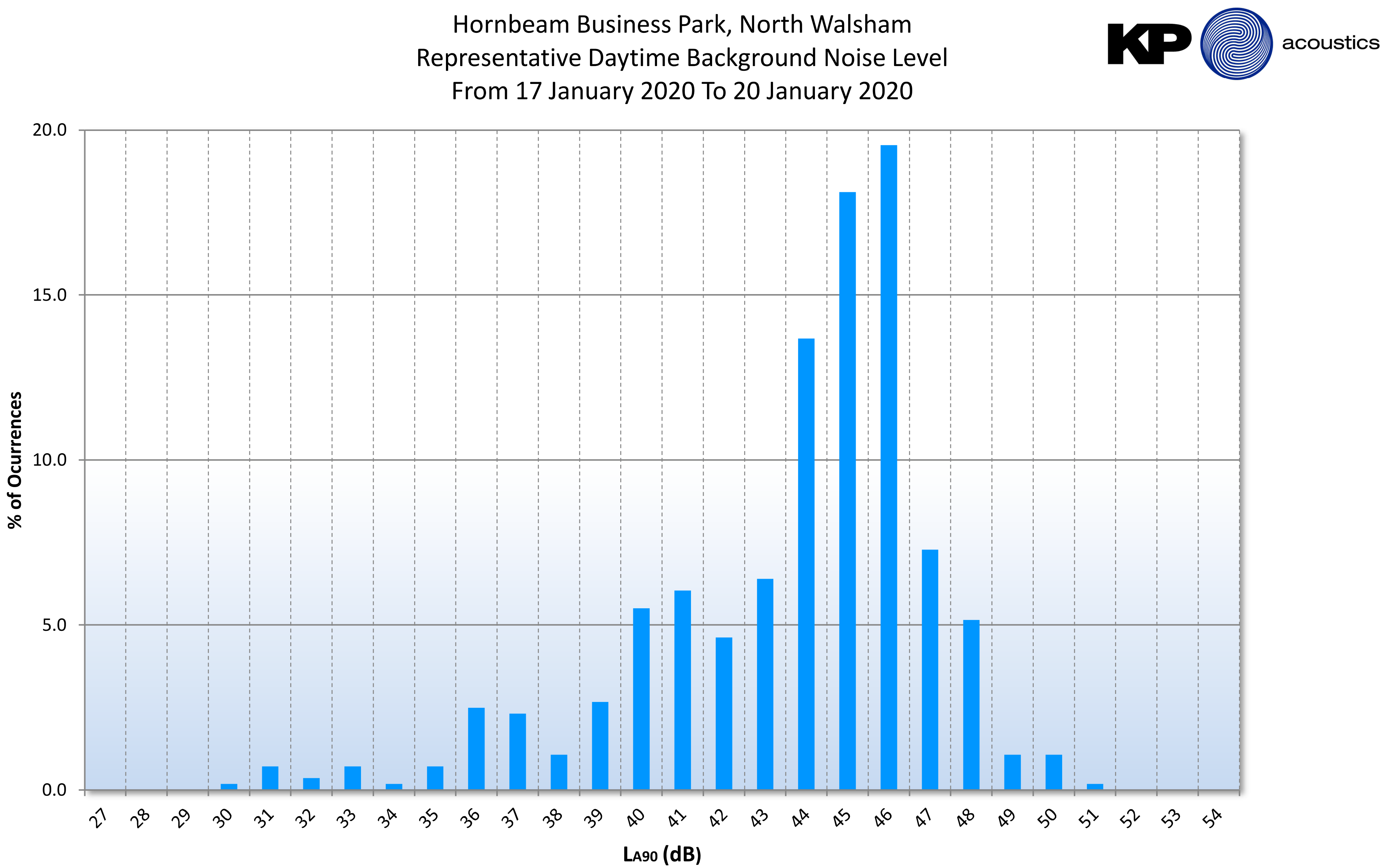


Figure 19793.L90-3

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the ‘decibel’, dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, ‘A’ weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a “not to exceed” criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of “background noise” for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

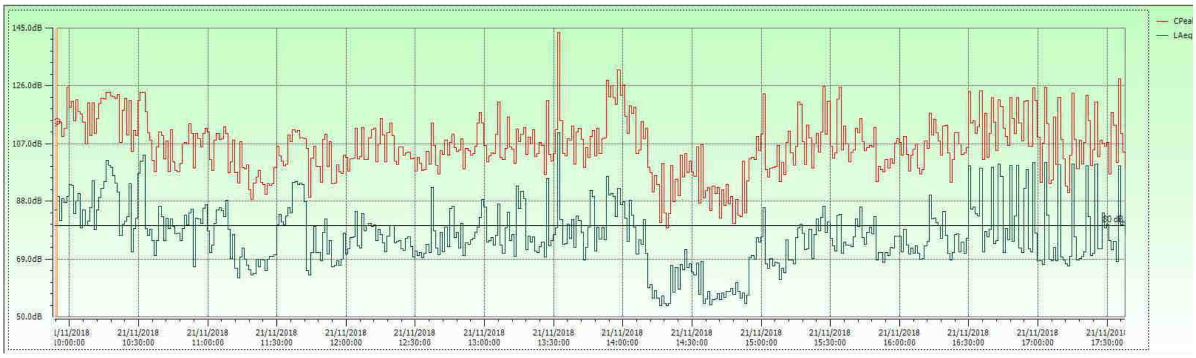
Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

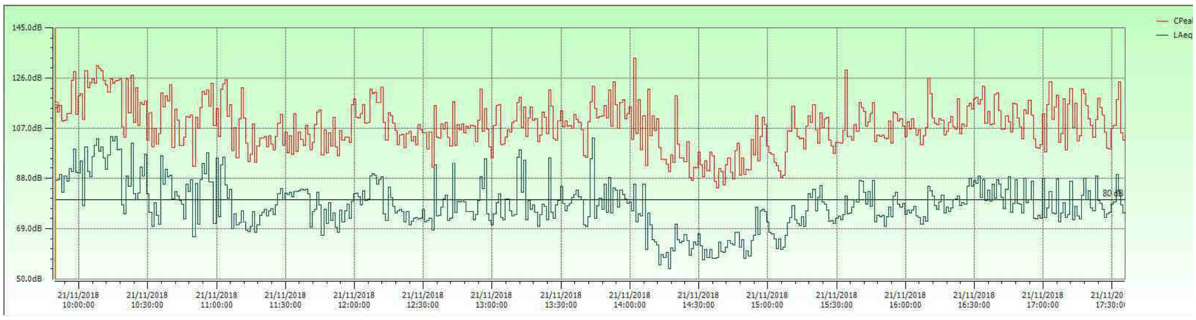
APPENDIX B

DOSE BADGES MEASUREMENTS FROM METALWORKING FACILITY

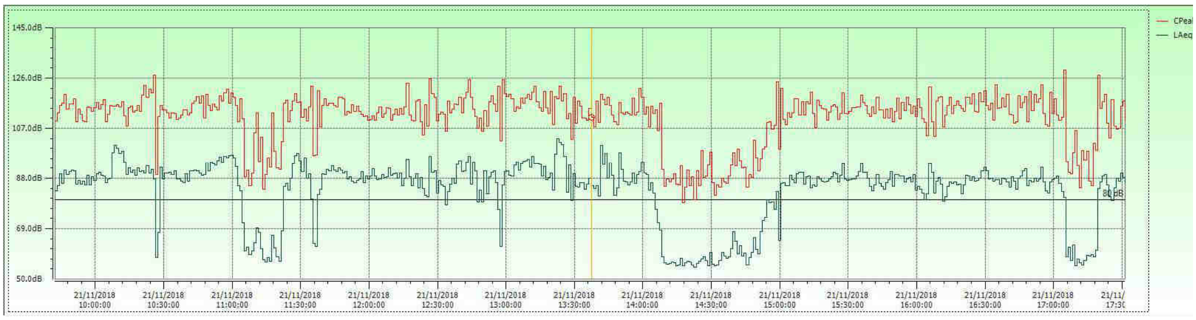
Operator 1 - 90dB(A)



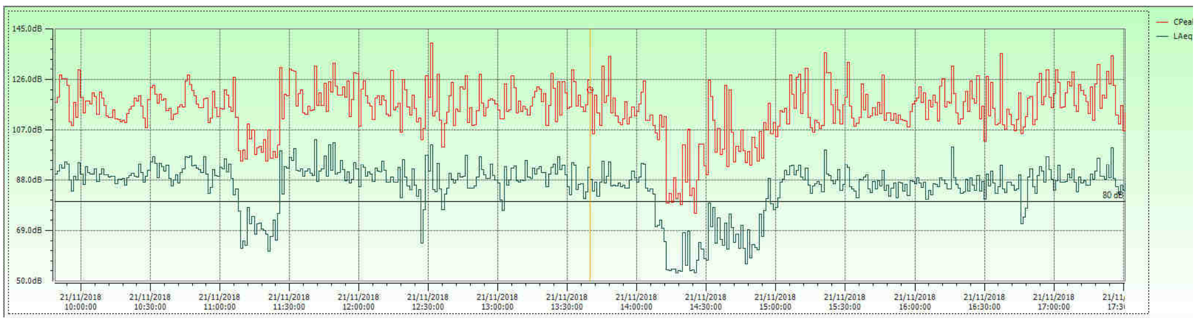
Operator 2 - 88dB(A)



Operator 3 - 90dB(A)



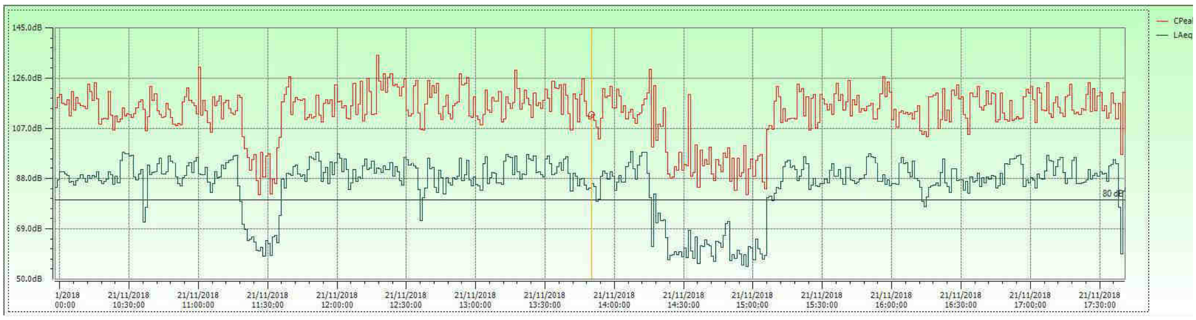
Operator 4 - 91dB(A)



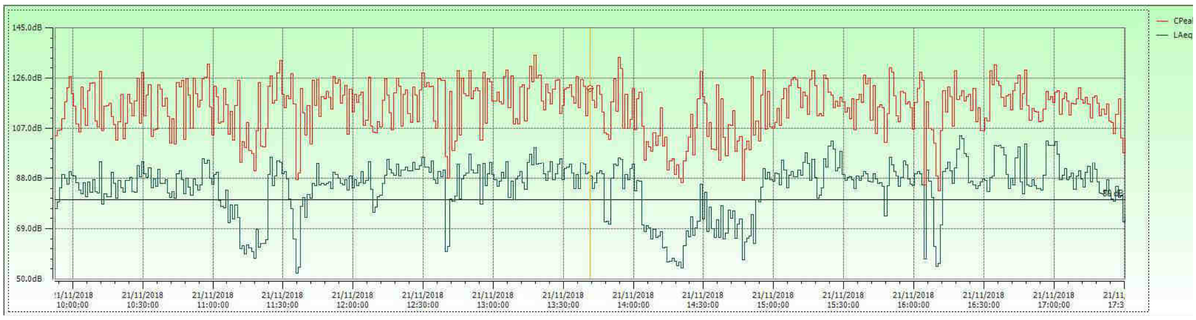
APPENDIX B

DOSE BADGES MEASUREMENTS

Operator 5 - 91dB(A)



Operator 6 - 91dB(A)



APPENDIX C1

Units H, I, J, K, L, M & N Hornbeam Business Park, North Walsham

NOISE BREAKOUT CALCULATIONS TO RECEIVER LOCATION 1

Source: Unit H **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit H	**91**
Conversion to sound power level, dB	11
Correction for room volume (800m³), dB	-15
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**83**
Correction for distance (68m), dB	-37
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit I **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit I	**91**
Conversion to sound power level, dB	11
Correction for room volume (800m³), dB	-15
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**83**
Correction for distance (68m), dB	-37
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit J **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit J	**91**
Conversion to sound power level, dB	11
Correction for room volume (1360m³), dB	-17
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (52m), dB	-34
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit K **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit K	**91**
Conversion to sound power level, dB	11
Correction for room volume (2720m³), dB	-20
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (160m²)	22
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (52m), dB	-34
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit L Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit L	**91**
Conversion to sound power level, dB	11
Correction for room volume (1600m³), dB	-18
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (50m), dB	-34
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit M Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit M	**91**
Conversion to sound power level, dB	11
Correction for room volume (1600m³), dB	-18
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (50m), dB	-34
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit N Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit N	**91**
Conversion to sound power level, dB	11
Correction for room volume (560m³), dB	-13
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**84**
Correction for distance (26m), dB	-28
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Total Specific Level at 1m From Receiver Façade, dB	**42**

Sources: Units H, I, J, K, L, M & N Receiver: Residential window of Receiver 1	dB(A)
Total Specific Level From Unit H at 1m From Receiver Façade, dE	32
Total Specific Level From Unit I at 1m From Receiver Façade, dE	32
Total Specific Level From Unit J at 1m From Receiver Façade, dE	32
Total Specific Level From Unit K at 1m From Receiver Façade, dE	32
Total Specific Level From Unit L at 1m From Receiver Façade, dE	32
Total Specific Level From Unit M at 1m From Receiver Façade, dE	32
Total Specific Level From Unit N at 1m From Receiver Façade, dE	42
Total Specific Level from all Units at 1m from Receiver Façade, dB	**44**
Correction for intermittency, dB	3
Correction for tonality, dB	2
Correction for impulsivity, dB	3
Total Rating Level from all Units at 1m from Receiver Façade, dB	**52**

Proposed Mitigation	dB(A)
Total Rating Level from all Units at 1m from Receiver Façade, dE	52
Kingspan KS1000 element external building fabric SRI, dB	25
Kingspan KS1000 panel, 10mm air gap, 70mm C stud, 2x12.5mm SoundBloc plasterboard SRI, dB	-50
Total Rating Level from all Units at 1m from Receiver Façade, dB	**27**

APPENDIX C2

Units H, I, J, K, L, M & N Hornbeam Business Park, North Walsham

NOISE BREAKOUT CALCULATIONS TO RECEIVER LOCATION 2

Source: Unit H **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit H	**91**
Conversion to sound power level, dB	11
Correction for room volume (800m³), dB	-15
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**83**
Correction for distance (82m), dB	-38
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dE	-5
Total Specific Level at 1m From Receiver Façade, dB	**25**

Source: Unit I **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit I	**91**
Conversion to sound power level, dB	11
Correction for room volume (800m³), dB	-15
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**83**
Correction for distance (72m), dB	-37
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dE	-5
Total Specific Level at 1m From Receiver Façade, dB	**27**

Source: Unit J **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit J	**91**
Conversion to sound power level, dB	11
Correction for room volume (1360m³), dB	-17
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (60m), dB	-36
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dE	-5
Total Specific Level at 1m From Receiver Façade, dB	**26**

Source: Unit K Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit K	**91**
Conversion to sound power level, dB	11
Correction for room volume (2720m³), dB	-20
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (160m²)	22
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (45m), dB	-33
Correction due to no reverberant field externally + propagation effect of the wall surface, dB	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**28**

Source: Unit L Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit L	**91**
Conversion to sound power level, dB	11
Correction for room volume (1600m³), dB	-18
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (27m), dB	-29
Correction due to no reverberant field externally + propagation effect of the wall surface, dB	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**32**

Source: Unit M Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit M	**91**
Conversion to sound power level, dB	11
Correction for room volume (1600m³), dB	-18
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (12m), dB	-22
Correction due to no reverberant field externally + propagation effect of the wall surface, dB	-14
Minimum attenuation provided by boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**39**

Source: Unit N Receiver: Residential window of Receiver 1	dB(A)
Sound Pressure level within in Unit N	**91**
Conversion to sound power level, dB	11
Correction for room volume (560m³), dB	-13
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**84**
Correction for distance (34m), dB	-31
Correction due to no reverberant field externally + propagation effect of the wall surface, dB	-14
Minimum attenuation provided by boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**35**

Sources: Units H, I, J, K, L, M & N Receiver: Residential window of Receiver 1	dB(A)
Total Specific Level From Unit H at 1m From Receiver Façade, dE	25
Total Specific Level From Unit I at 1m From Receiver Façade, dE	27
Total Specific Level From Unit J at 1m From Receiver Façade, dE	26
Total Specific Level From Unit K at 1m From Receiver Façade, dE	28
Total Specific Level From Unit L at 1m From Receiver Façade, dE	32
Total Specific Level From Unit M at 1m From Receiver Façade, dE	39
Total Specific Level From Unit N at 1m From Receiver Façade, dE	35
Total Specific Level from all Units at 1m from Receiver Façade, dB	**42**
Correction for intermittency, dB	3
Correction for tonality, dB	2
Correction for impulsivity, dB	3
Total Rating Level from all Units at 1m from Receiver Façade, dB	**50**

Proposed Mitigation	dB(A)
Total Rating Level from all Units at 1m from Receiver Façade, dE	50
Kingspan KS1000 element external building fabric SRI, dB	25
Kingspan KS1000 panel, 10mm air gap, 70mm C stud, 2x12.5mm SoundBloc plasterboard SRI, dB	-50
Total Rating Level from all Units at 1m from Receiver Façade, dB	**25**

APPENDIX C3

Units H, I, J, K, L, M & N Hornbeam Business Park, North Walsham

NOISE BREAKOUT CALCULATIONS TO RECEIVER LOCATION 3

Source: Unit H **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit H	**91**
Conversion to sound power level, dB	11
Correction for room volume (800m³), dB	-15
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**83**
Correction for distance (94m), dB	-39
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dE	-5
Total Specific Level at 1m From Receiver Façade, dB	**24**

Source: Unit I **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit I	**91**
Conversion to sound power level, dB	11
Correction for room volume (800m³), dB	-15
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**83**
Correction for distance (86m), dB	-39
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dE	-5
Total Specific Level at 1m From Receiver Façade, dB	**25**

Source: Unit J **Receiver: Residential window of Receiver 1**	***dB(A)***
Sound Pressure level within in Unit J	**91**
Conversion to sound power level, dB	11
Correction for room volume (1360m³), dB	-17
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (71m), dB	-37
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by building envelope of other units blocking line of site as well as boundary fence separating residential units from commercial area, dE	-5
Total Specific Level at 1m From Receiver Façade, dB	**24**

Source: Unit K Receiver: Residential window of Receiver 1	*dB(A)*
Sound Pressure level within in Unit K	**91**
Conversion to sound power level, dB	11
Correction for room volume (2720m³), dB	-20
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (160m²)	22
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (55m), dB	-35
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**27**

Source: Unit L Receiver: Residential window of Receiver 1	*dB(A)*
Sound Pressure level within in Unit L	**91**
Conversion to sound power level, dB	11
Correction for room volume (1600m³), dB	-18
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (48m), dB	-34
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**27**

Source: Unit M Receiver: Residential window of Receiver 1	*dB(A)*
Sound Pressure level within in Unit M	**91**
Conversion to sound power level, dB	11
Correction for room volume (1600m³), dB	-18
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**80**
Correction for distance (45m), dB	-33
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**28**

Source: Unit N Receiver: Residential window of Receiver 1	*dB(A)*
Sound Pressure level within in Unit N	**91**
Conversion to sound power level, dB	11
Correction for room volume (560m³), dB	-13
Correction for reverberation time (1.5s), dB	2
Correction for area (S) of the façade overlooking receiver location (80m²)	19
Composite SRI of façade, dB	-25
Total Sound Breakout From Industrial Units, dB	**84**
Correction for distance (10m), dB	-20
Correction due to no reverberant field externally + propagation effect of the wall surface, dE	-14
Minimum attenuation provided by boundary fence separating residential units from commercial area, dB	-5
Total Specific Level at 1m From Receiver Façade, dB	**45**

Sources: Units H, I, J, K, L, M & N Receiver: Residential window of Receiver 1	dB(A)
Total Specific Level From Unit H at 1m From Receiver Façade, dB	24
Total Specific Level From Unit I at 1m From Receiver Façade, dB	25
Total Specific Level From Unit J at 1m From Receiver Façade, dB	24
Total Specific Level From Unit K at 1m From Receiver Façade, dB	27
Total Specific Level From Unit L at 1m From Receiver Façade, dB	27
Total Specific Level From Unit M at 1m From Receiver Façade, dB	28
Total Specific Level From Unit N at 1m From Receiver Façade, dB	45
Total Specific Level from all Units at 1m from Receiver Façade, dB	**46**
Correction for intermittency, dB	3
Correction for tonality, dB	2
Correction for impulsivity, dB	3
Total Rating Level from all Units at 1m from Receiver Façade, dB	**54**

Proposed Mitigation	dB(A)
Total Rating Level from all Units at 1m from Receiver Façade, dB	54
Kingspan KS1000 element external building fabric SRI, dB	25
Kingspan KS1000 panel, 10mm air gap, 70mm C stud, 2x12.5mm SoundBloc plasterboard SRI, dB	-50
Total Rating Level from all Units at 1m from Receiver Façade, dB	**29**

Sound Insulation Prediction (v9.0.20)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
- Key No. 2581
Job Name:Hornbeam Business Park
Job No.: 19793 Initials:Daniel Green MIOA
Date:27/01/2020
File Name:

Notes:

Rw 50 dB
C -5 dB
Ctr -13 dB

Mass-air-mass resonant frequency = =74 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 26.7 kg/m²

System description

Panel 1 : 1 x 40.5 mm Kingspan KS1000 RW 30/40mm(Copy)

Frame: Right steel stud + air gap (75 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 85 mm , 1 x Rockwool (40kg/m3) Thickness 50 mm
Panel 2 : 2 x 12.5 mm Gyproc Wallboard 12.5mm

freq.(Hz)	R(dB)	R(dB)
50	17	
63	17	16
80	14	
100	19	
125	25	22
160	31	
200	36	
250	41	40
315	46	
400	51	
500	55	54
630	60	
800	66	
1000	69	68
1250	71	
1600	72	
2000	71	68
2500	65	
3150	57	
4000	65	61
5000	79