

BS4142:2014 ASSESSMENT OF
THE DIZZ HUB,
EBBSFLEET RAINBOW CENTER,
ROSE STREET,
NORTHFLEET,
KENT
DA11 9EQ



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1.0 Introduction

- 1.0.1 This report has been commissioned to determine the noise impact of the plant noise from the West and South facades of the Dizz Hub, Ebbsfleet Rainbow Center, Rose Street, Northfleet, Kent DA11 9EQ.
- 1.0.2 The assessment has been conducted in line with the BS4142:2014 in order to assess the industrial sources with the potential for noise impact on surrounding residential properties.

2.0 Site Details

- 2.0.1 The Dizz Hub is an African foods shop located off station road in Northfleet. The site has plant units located on the Western façade at first-floor roof level, and a further set of plant on the southern plant located where the outdoor freezer & chiller unit are situated. There are also some AC plant units located above the chiller which have been assessed as part of the measurements taken in that area.
- 2.0.2 The air handling systems and plant units have all been identified on the existing plans for the site and entered into the models for prediction of the specific noise level of the combined development. This will compare existing noise levels with and without the existing units for a robust assessment.
- 2.0.3 The closest Noise Sensitive Receptors (NSRs) are located on Ebbsfleet Walk and Rose Street which are situated to the rear of the assessment property and to the East.
- 2.0.4 The noise sources are all in existence therefore a 24hr assessment was taken at two locations. Calculations were then made based on the on/off times from the measurements taken. The CadnaA noise modelling software has then been used to determine the specific noise level of the combined sources at the NSRs based on the 'on-time' of the industrial units.

2.1 Location of Monitors

- 2.1.1 The noise location was chosen based on the proximity to the closest NSR.

Figure 1 – West-Boundary sources



Figure 2 – South Chiller & AC Units



- 2.1.2 Measurements were made in 15 minute periods, on 1 second averaging, to allow for the removal of anomalies and increased accuracy. The data was averaged into L_{Aeq1hr} daytime and $L_{Aeq15min}$ night-time with data also recorded for L_{A90} in both day and night periods for the BS4142:2014 assessment.
- 2.1.3 The monitoring was conducted using 2 x Type 1 Nti XL2 sound level meter with batteries and outdoor microphone protection.
- 2.1.4 All measurements were taken after a field calibration was undertaken to ensure accuracy and repeatability of measurements. Drift was also checked post-measurement to validate the data collected.
- 2.1.5 Further data such as wind speed, wind direction, rainfall intensity, temperature and cloud cover were all recorded at the beginning and end of the assessment at the monitoring location.
- 2.1.6 Any anomalies (such as noise by the engineer during setup and collection of the kit) were removed from the survey for a true reflection of the ambient levels in the vicinity. This was done by recording audio throughout the survey at each location and listening back through the files during the analysis process to confirm what was recorded manually during the survey.

2.2 Plan Views of Site with Designated Work Areas

Figure 3



3.0 Legislation

3.0.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 174 of the NPPF states the following:

"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...."

Paragraph 185 goes on to mention:

"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;"

3.0.2 The NPPF reinforces the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

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

- avoid significant adverse impacts on health and quality of life;

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

3.0.3 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.1 BS4142:2014 +A1 (2019)

- 3.1.1 Noise effects on residential properties due to the current operational hours and extended hours have been assessed according to the guidance in BS 4142:2014. This standard primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the proposed development) at residential sensitive receptors.
- 3.1.2 The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level', whether or not a rating penalty is applied. The 'residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
- 3.1.3 According to BS 4142:2014, the background sound levels adopted for the assessment should be representative of the periods being assessed. The standard recommends that the background sound level should be collected from continuous measurements of normally not less than 15-minute intervals. However, the Standard states that there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period because it can be subject to a wide variation in background sound levels between the shoulder night periods.

- 3.1.4 The method chosen for this section of the report is to use the data collected at the nearest NSR for the day and night periods to provide the ambient and background noise levels. The mode $L_{Aeq_1hr(Day)}$ and $L_{Aeq_15min(Night)}$ value will then be used for each time period over the course of the measurement as the most appropriate way of creating a representative value.
- 3.1.5 The specific sound levels have been determined separately in terms of the L_{Aeq_1hr} during the daytime L_{Aeq_15min} during the night-time. Daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours, so these periods have been adopted for this assessment.
- 3.1.6 At each of the most likely sensitive receptor locations, the rating level has been determined from the predicted specific sound level. Where it has been considered it to be appropriate, a rating penalty has been applied for tonality, impulsivity and/or intermittent specific sounds as described in the commentary to paragraph 9.2 of BS4142:2014. This has been applied with consideration for the main sound sources from site that contribute to the level of specific sound at the receptor location.
- 3.1.7 As per the requirements of the standard, an initial estimate of the impact of the specific sound has been obtained by subtracting the measured background sound level from the rating level of the specific sound. Table 2 provides the initial evaluation of impact following this method.

Table 1

Magnitude	Difference Between rating Level and Background Level	Comments
High	+10dB	Significant Adverse impact Likely
Medium	+5 to +10dB	Adverse impact Likely
Low	0 to +5 dB	Low Chance of Adverse Impact
Negligible	Less than 0dB	Low Chance of Adverse Impact
No Change	-10 dB	No adverse impact

- 3.1.8 Following the initial evaluation of impact, the context of the sound has also been considered, which is a key requirement of the Standard. In evaluation of the context, the following factors have been considered:

- the absolute level of the sound;

- the character and level of the residual sound compared to the character and level of the specific sound and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

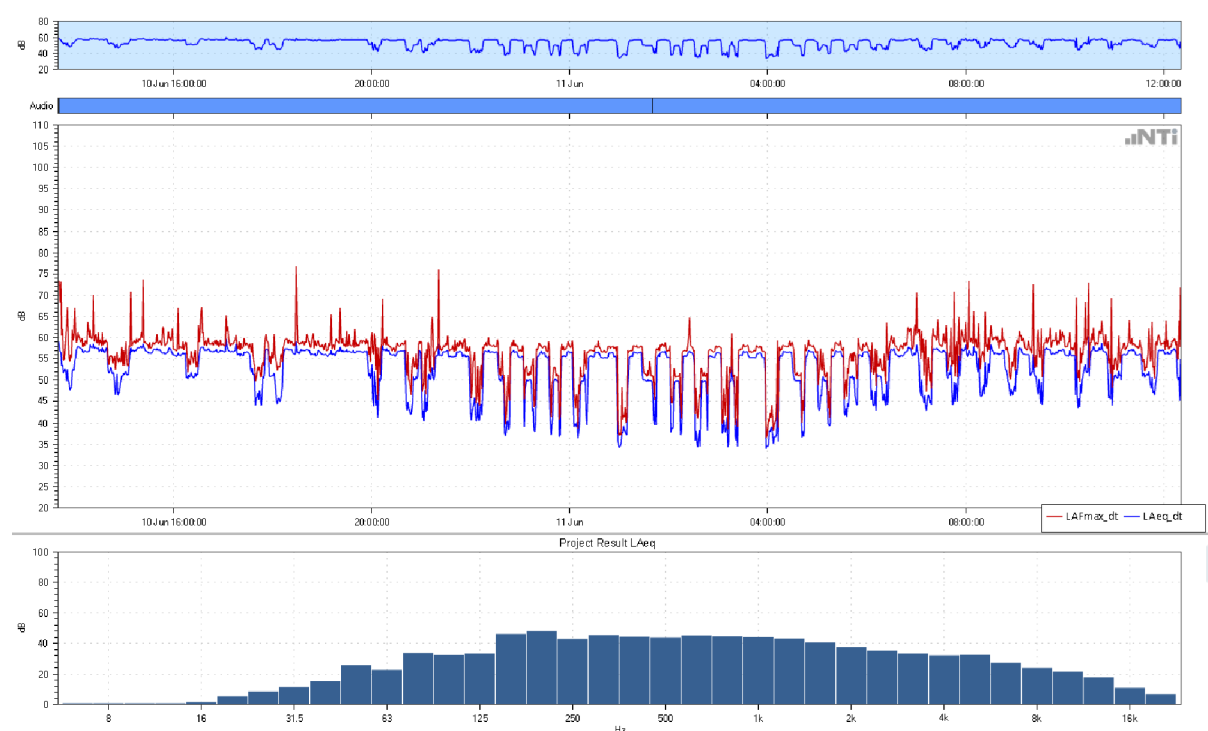
4.0 Results

4.1 – West-Façade Plant – 13.40pm 10/06/25 – 12.15pm 11/06/25

Table 2

<i>Time Period</i>	<i>Start Date/Time</i>	<i>L_{Amax}</i>	<i>L_{Aeq1hr} (Mode)</i>	<i>L_{Aeq15min} (Mode)</i>	<i>L_{A90} (Mode)</i>
<i>Day (0700-2300)</i>	11.59am 08/04/25	76.4dBA	55.3dBA		49.2dBA
<i>Night (2300-0700)</i>	23.00pm 08/04/25	65.3dBA		52.1dBA	38.1dBA

Figure 4



Comments

Distinctive on/off noise from plant units. Broadband noise output.

*based on Appendix C

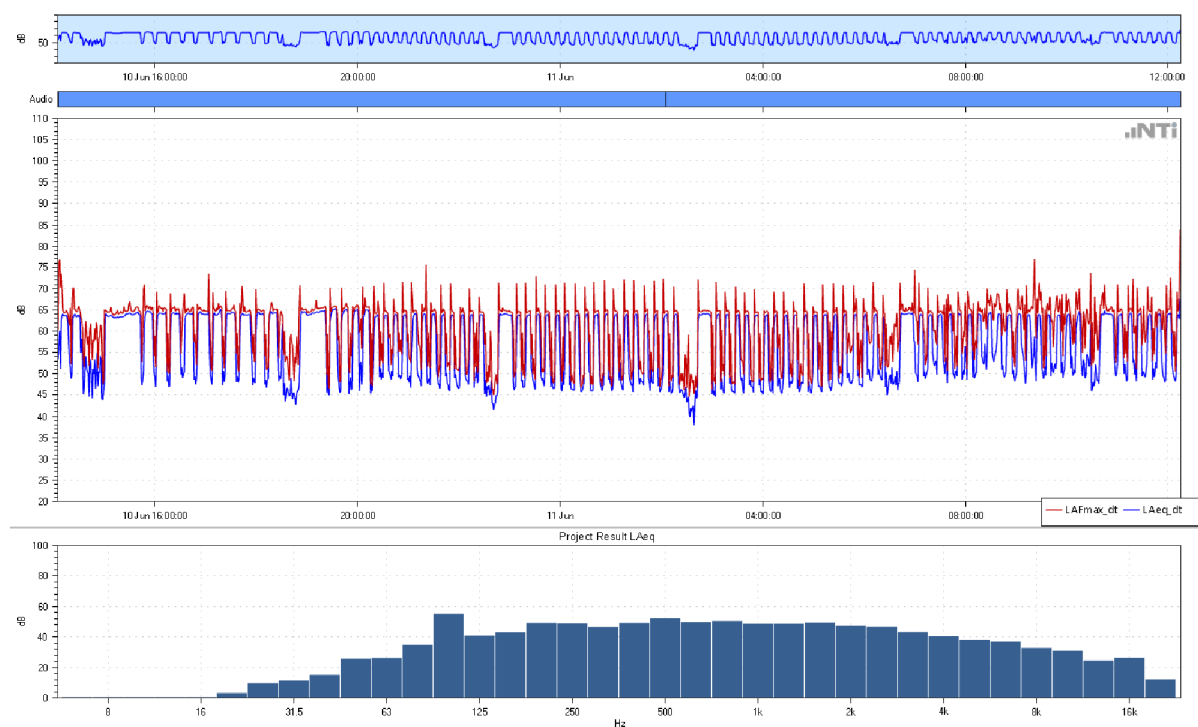
Time Period	Cloud Cover	Temperature (Celcius)	Prescence of fog/snow/ice	Wind Speed (m/s)	Wind Direction
Installation	1	22	No	1.9	NE
Collection	2	24	No	0.6	N

4.2 – South-East façade – Chiller/Freezer & AC Units -14.05pm 10/06/25 – 12.00pm 11/06/25

Table 3

Time Period	Start Date/Time	L _{Amax}	L _{Aeq1hr} (Mode)	L _{Aeq15min} (Mode)	L _{A90}
Day (0700-2300)	11.12pm – 11.43am	77.6dBA	60.2dBA		47.9dBA
Night (2300-0700)	23.00pm 08/04/25	74.3dBA		60.4dBA	46.1dBA

Figure 5



Comments

High Variations between on/off of AC units. Tonal noise. Due to access restrictions it is difficult to distinguish the exact location of the source of the noise variation.

**based on Appendix C*

Time Period	Cloud Cover	Temperature (Celcius)	Presence of fog/snow/ice	Wind Speed (m/s)	Wind Direction
Installation	1	22	No	1.0	NE
Collection	2	24	No	0.2	N

5.0 Analysis of Results

5.1 Calculated Results

5.1.1 The specific noise level for the existing air-conditioning units and freezer/chiller has been calculated using the measured data from the unattended assessments. This looks at the period of time where the units are clearly on and off to provide the ambient and residual values. Figures 6 & 7 below show the zoomed-in version of the assessment where the two periods of on/off can be clearly identified.

As there are clearly some distinctive plant noise sources on both sides of the building; the BS4142:2014 calculation method has been used to obtain the specific noise level at the measurement location for each side of the building. These values have then been entered into the CadnaA noise modelling software to look at the impact on the surrounding Noise Sensitive Receptor (NSR) locations, and provide a combined specific noise level at each NSR.

5.1.2 As the background noise levels quoted in tables 2 & 3 are inclusive of the plant noise; the lowest background noise value has been taken in each measurement time period (day and night). This provides the most accurate impact calculation if the plant noise was not present on the site.

Figure 6 – West Façade zoomed-in view of plant on/off

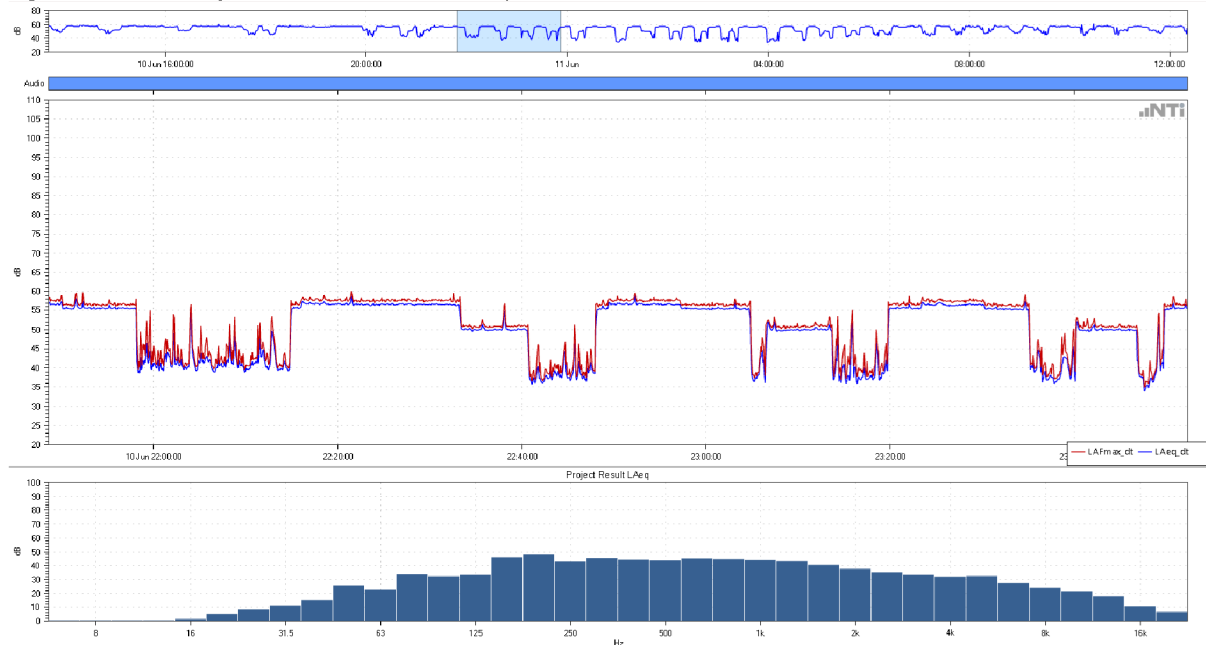
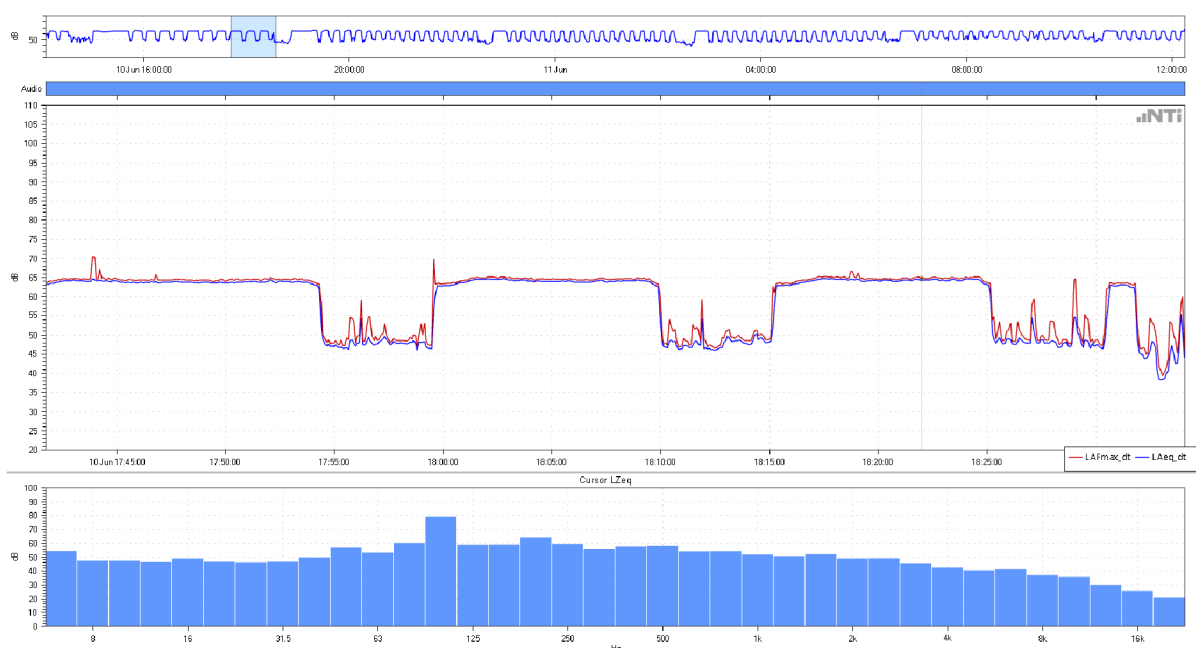


Figure 7 – Southern Boundary showing Chiller/Freezer & AC units zoomed-in time frame



5.1.3 Using the assessment periods shown in figure 6 & 7 it can be seen that, to the West boundary of the development, the ambient levels when all plant units are active averages 57dBA, whereas the residual period for the measurement is around 39dBA. This provides a specific noise level for the existing units of 56.9dBA, rounded to 57dBA. This value is the specific noise level at 3m from the source. It shows the plant is the dominant noise source.

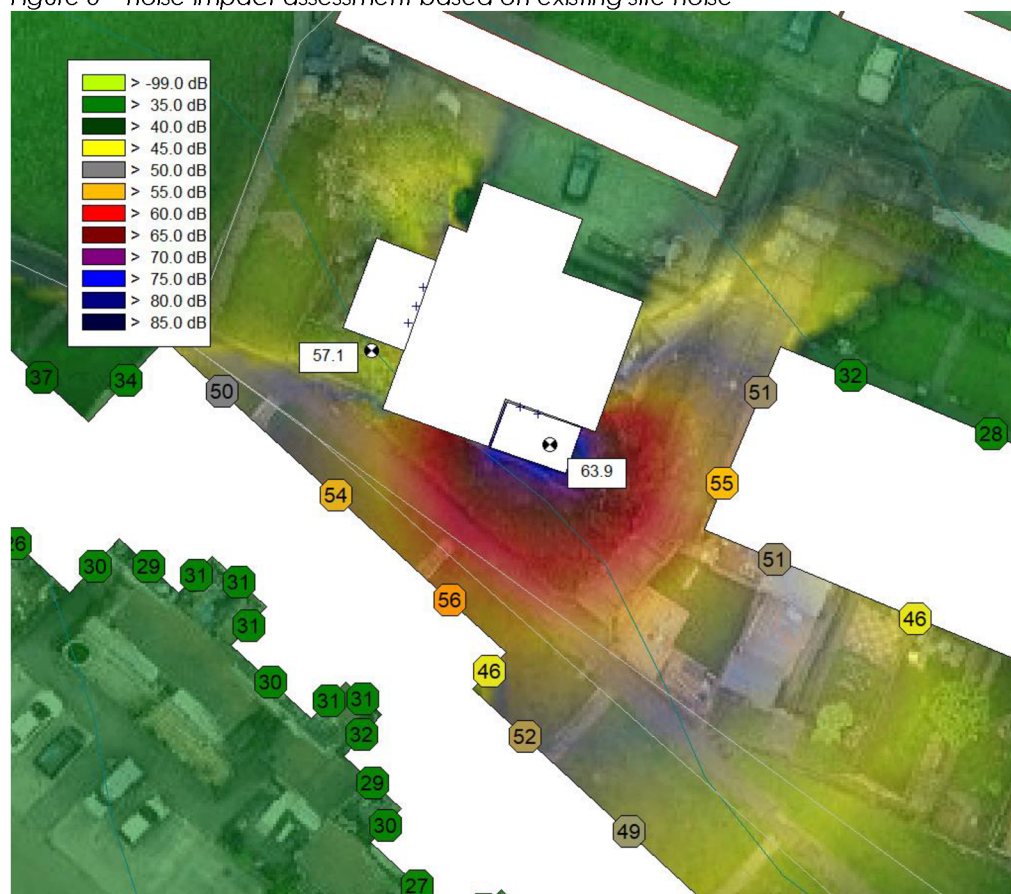
5.1.4 The chiller/freezer and AC units on the southern boundary can be calculated in the same manner using figure 7. The ambient levels when all plant units are active averages 64dBA, whereas the residual period for the measurement is around 48dBA. This provides a specific noise level for the existing units of 63.9dBA, rounded to 64dBA. This value is the specific noise level at 1m from the source. The 48dBA is also likely to include the noise from the chiller/freezer but it was evident that the dominant noise source was the tonal AC units or part of the chiller/freezer that is not active 24/7.

5.1.5 These calculated values have then been used in the CadnaA modelling software to determine the existing noise impact from the existing sources on the site. Figure 8 provides the noise impact map for the existing sources, and the impact they have on the surrounding Noise Sensitive Receptor (NSR) points. Table 4 below summarises the values that have been used in the CadnaA software as the receiver-point specific noise level, and then the background noise values used at the NSRs.

Table 4 – Calculated entry values

Location	Specific Noise Level (dBA)	Distance from Source (m)	Background Noise Level (L _{A90})
Western boundary	57dBA	3	45dBA
South Boundary	64dBA	1	40dBA

Figure 8 – noise impact assessment based on existing site noise



5.1.4 With the calculated specific noise level being at a maximum of 56dBA at the closest NSR window, and 55dBA at the next; 56dBA has been used in the calculations in table 5 to assess the noise impact of the units.

Table 5

Measurement Type	Parameter	Result	Comment
Day			
Ambient sound	L _{Aeq}	58dBA	Measured - Source present intermittently
Residual sound level	L _{Aeq1hr}	42dBA	Measured - Source not present
Background sound level	L _{A901hr}	40dBA	Measured at NSR- Source not present
Specific Sound Level	L _{Aeq1hr}	56dBA	Modelled

<i>Acoustic Feature Correction</i>	dBA	+4	Tonal noise from chiller/freezer area
<i>Rating Level</i>	dBA	60dBA	
<i>Difference of Background vs Rating level</i>	dBA	+20dB	
<i>Likelihood of complaints</i>			Significant Adverse Impact

6.0 Conclusion and Further Comments

6.1 Discussion of Levels

- 6.1.1 The specific noise level of the air handling units and the chiller/freezer area are above the required levels, in accordance with BS4142:2014, therefore returning a value of 'significant adverse impact expected'
- 6.1.2 There was a variation in the two sides of the building that were assessed. The plant noise on the western boundary was calculated as 57dBA 3m from the sources whereas the chiller/freezer area was calculated as 64dBA 1m from the sources. If a noise impact for just the western boundary sources is used the highest value at the nearest NSR is 46dBA. This would, however, still be 6dB above the background noise level for the area and likely to cause adverse impact at the nearest NSRs.

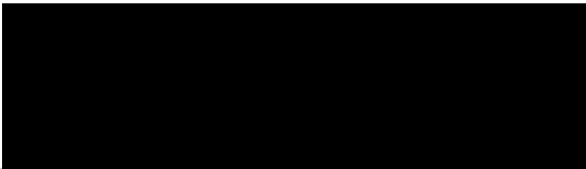
6.2 Mitigation Measures

- 6.2.1 While there are some options for mitigation measures at the site, it is likely that there needs to be a rethink on the locations and heights where the units have been mounted. As all of the AC units are mounted at least 3m above the ground they will provide significantly more noise impact than mounting at ground level. Just moving the units on the Western boundary from roof-level to ground floor will reduce the noise impact on the nearest NSRs by a further 8dB. This would bring the noise impact for that side of the building down below background noise levels.
- 6.2.2 A second option for the Western boundary would be to add a screen around the AC units. This would need to be a minimum of 1.5m out from the wall and 1.5m in height. The barrier would also need to be of a density of at least 10kg/m³ in order to provide the required attenuation in the noise levels. This would also bring the

noise levels at the nearest NSRs below the required background noise levels.

- 6.2.3 The southern boundary where the chiller/freezer and AC units are located requires more significant attenuation. Any treatment on this area would require a noise reduction of at least 20dBA. This may be achieved in the form of a screen replacing the existing railings to the exterior of the chiller/freezer but the fencing would need to be at least 5m in height. This may cause issues with the planning authority as barriers of such height are often refused. The barrier type would also need to be of acoustic quality. Some examples have been provided in Appendix E.
- 6.2.4 It is advised that the age of the AC units above the chiller is assessed along with their efficiency as newer units may also reduce the noise impact in this area. The manufacturer of the chiller/freezer unit should also be contacted to see if there are suitable acoustic enclosures that can be specified for the unit, or improvements that can be made that may benefit the noise outcome from the unit. This is so that the noise levels can be reduced without compromising on the performance or safety of the plant in that unit.
- 6.2.5 As previously stated; the lack of access to the AC units and the rear of the chiller area has made it difficult to be 100% certain on the cause of the elevated noise in that area. Looking at the graphs in figures 5 and 7, and assuming the chiller/freezer unit is functioning 24/7, it is more likely that the AC units above the chiller are the main cause. This should be the focus of maintenance and/or replacement for much quieter units. Any new units will need to be a maximum of 50dBA 1m from the source, or for attenuation considerations to be made at the point of purchasing.
- 6.2.6 Testing should be done post any mitigation measures, prior to full submission to the council, to make sure that the noise levels are no longer going to cause the significant adverse impact the current layout and units do.

7.0 Credentials

Name	Title	Credentials
James Flitton BSc AMIOA	Acoustic Consultant	CSCS Professionally Qualified person
		Associate Member Institute of Acoustics
		Affiliate Member of IDE
		IOA Diploma in Acoustics & Noise Control
Signed		

Appendix A – Acoustic Terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. 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 $20 \mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.

Parameter	Description
$L_{Aeq,T}$	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 recorded during a noise event with a 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.
$L_{10,T}$	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. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B – Survey Instrumentation

Type	Manufacturer	Model	Serial Number	Last Cal	Cal Due
SLM	NTi	XL2-TA	A2A-18475-E0	12/11/2024	12/11/2026
Pre-amp	NTi	MA220	9378	12/11/2024	12/11/2026
Microphone	NTi	MC230A	A19093	12/11/2024	12/11/2026
Calibrator	NTi	CAL200	19829	12/11/2024	12/11/2025
SLM	NTi	XL2-TA	A2A-23651-E1	17/04/2024	17/04/2026
Pre-amp	NTi	MA220		17/04/2024	17/04/2026
Microphone	NTi	MC230A		17/04/2024	17/04/2026

Appendix C – Weather Conditions Chart Used

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Error! Reference source not found.		Temperature:		
Cloud Cover Symbol Scale in oktas (eighths)  0 Sky completely clear  1  2  3  4 Sky half cloudy  5  6  7  8 Sky completely cloudy  (9) Sky obstructed from view		Precipitation:		
		Cloud cover (oktas - see guide)		
		Presence of fog/snow/ice		
		Presence of damp roads/wet ground		

	Wind Speed (m/s)		
	Wind Direction		
	Conditions that may cause temperature inversion (i.e. calm nights with no cloud)		

Appendix D – CadnaA Calculation Sheet

Receiver
Name: NSR1
ID:
X: 31314226.53m
Y: 5702734.97m
Z: 23.80 m

vert. Area Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
8	314232.27	5702743.14	22.67	0	DEN	500	72.0	4.0	0.0	3.0	0.0	31.0	0.0	0.2	0.0	0.0	17.2	0.0	0.0	30.7
11	314229.88	5702743.96	22.58	0	DEN	500	72.0	4.0	0.0	3.0	0.0	30.6	0.0	0.1	0.0	0.0	15.3	0.0	0.0	32.9
17	314232.27	5702743.14	21.67	0	DEN	500	72.0	4.0	0.0	3.0	0.0	31.1	0.0	0.9	0.0	0.0	16.7	0.0	0.0	30.3
21	314229.88	5702743.96	21.58	0	DEN	500	72.0	4.0	0.0	3.0	0.0	30.7	0.0	0.9	0.0	0.0	15.0	0.0	0.0	32.4
25	314232.27	5702743.14	20.67	0	DEN	500	72.0	4.0	0.0	3.0	0.0	31.2	0.0	2.3	0.0	0.0	15.9	0.0	0.0	29.6
29	314229.88	5702743.96	20.58	0	DEN	500	72.0	4.0	0.0	3.0	0.0	30.9	0.0	2.2	0.0	0.0	14.4	0.0	0.0	31.5

Area Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
33	314229.23	5702745.33	20.14	0	DEN	500	72.0	-4.2	0.0	0.0	0.0	31.9	0.0	2.7	0.0	0.0	17.2	0.0	0.0	16.0
38	314230.76	5702744.80	20.20	0	DEN	500	72.0	8.3	0.0	0.0	0.0	31.9	0.0	2.7	0.0	0.0	17.2	0.0	0.0	28.5
45	314233.31	5702742.93	20.22	0	DEN	500	72.0	20.2	0.0	0.0	0.0	31.7	0.0	2.7	0.0	0.0	17.2	0.0	0.0	0.2
60	314232.34	5702745.46	20.35	0	DEN	500	72.0	7.7	0.0	0.0	0.0	32.8	0.0	3.0	0.0	0.0	16.9	0.0	0.0	27.0
63	314233.54	5702744.05	20.32	0	DEN	500	72.0	0.4	0.0	0.0	0.0	32.4	0.0	2.9	0.0	0.0	17.0	0.0	0.0	20.1
66	314233.43	5702743.06	20.24	0	DEN	500	72.0	14.0	0.0	0.0	0.0	31.8	0.0	2.7	0.0	0.0	17.2	0.0	0.0	6.3

vert. Area Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
49	314229.22	5702745.85	22.68	0	DEN	500	72.0	5.0	0.0	3.0	0.0	32.0	0.0	0.2	0.0	0.0	17.5	0.0	0.0	30.2
54	314229.22	5702745.85	20.68	0	DEN	500	72.0	5.0	0.0	3.0	0.0	32.2	0.0	2.5	0.0	0.0	17.4	0.0	0.0	27.9
57	314229.22	5702745.85	21.68	0	DEN	500	72.0	5.0	0.0	3.0	0.0	32.0	0.0	1.0	0.0	0.0	18.3	0.0	0.0	28.6

vert. Area Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
69	314234.12	5702744.62	21.91	0	DEN	500	72.0	3.6	0.0	3.0	0.0	32.8	0.0	1.1	0.0	0.0	18.6	0.0	0.0	26.1
72	314233.61	5702743.14	21.75	0	DEN	500	72.0	-0.6	0.0	3.0	0.0	31.7	0.0	1.0	0.0	0.0	18.9	0.0	0.0	22.7
75	314234.12	5702744.62	20.91	0	DEN	500	72.0	3.6	0.0	3.0	0.0	32.9	0.0	2.7	0.0	0.0	18.2	0.0	0.0	24.7
78	314233.61	5702743.14	20.75	0	DEN	500	72.0	-0.6	0.0	3.0	0.0	31.9	0.0	2.4	0.0	0.0	17.5	0.0	0.0	22.6
81	314234.12	5702744.62	22.91	0	DEN	500	72.0	3.6	0.0	3.0	0.0	32.8	0.0	0.2	0.0	0.0	17.7	0.0	0.0	27.9
84	314233.61	5702743.14	22.75	0	DEN	500	72.0	-0.6	0.0	3.0	0.0	31.7	0.0	0.2	0.0	0.0	19.2	0.0	0.0	23.2

Point Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB(A)
87	314230.62	5702746.96	25.36	0	DEN	500	74.5	0.0	0.0	0.0	0.0	33.2	0.0	0.0	0.0	0.0	4.8	0.0	0.0	36.4

Point Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
91	314231.72	5702746.55	25.41	0	DEN	500	74.5	0.0	0.0	0.0	0.0	33.2	0.0	0.0	0.0	0.0	4.8	0.0	0.0	36.4

Point Source, ISO 9613, Name: "", ID: "I00!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
95	314223.61	5702752.21	24.13	0	DEN	500	74.5	0.0	0.0	0.0	0.0	35.9	0.0	0.0	0.0	0.0	22.9	0.0	0.0	15.7

Point Source, ISO 9613, Name: "", ID: "I00!"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
99	314224.06	5702753.32	24.13	0	DEN	500	74.5	0.0	0.0	0.0	0.0	36.4	0.0	0.0	0.0	0.0	22.5	0.0	0.0	15.6

Receiver
Name: NSR2
ID:
X: 31314243.20m
Y: 5702742.31m
Z: 23.80 m

vert. Area Source, ISO 9813, Name: "", ID: "I01!"																			
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
14	314232.47	5702743.08	22.67	0	DEN	500	72.0	3.3	0.0	3.0	0.0	31.8	0.0	0.2	0.0	0.0	17.4	0.0	28.9
20	314230.68	5702743.69	22.61	0	DEN	500	72.0	2.2	0.0	3.0	0.0	33.1	0.0	0.2	0.0	0.0	16.3	0.0	27.5
23	314229.29	5702744.16	22.58	0	DEN	500	72.0	1.1	0.0	3.0	0.0	34.0	0.0	0.2	0.0	0.0	15.4	0.0	26.5
27	314232.47	5702743.08	21.67	0	DEN	500	72.0	3.3	0.0	3.0	0.0	31.9	0.0	1.0	0.0	0.0	17.9	0.0	27.5
30	314230.68	5702743.69	21.61	0	DEN	500	72.0	2.2	0.0	3.0	0.0	33.2	0.0	1.1	0.0	0.0	17.2	0.0	25.6
34	314229.29	5702744.16	21.58	0	DEN	500	72.0	1.1	0.0	3.0	0.0	34.1	0.0	1.2	0.0	0.0	16.3	0.0	24.4
37	314232.47	5702743.08	20.67	0	DEN	500	72.0	3.3	0.0	3.0	0.0	32.1	0.0	2.4	0.0	0.0	17.1	0.0	26.6
41	314230.68	5702743.69	20.61	0	DEN	500	72.0	2.2	0.0	3.0	0.0	33.4	0.0	2.8	0.0	0.0	16.9	0.0	24.0
44	314229.29	5702744.16	20.58	0	DEN	500	72.0	1.1	0.0	3.0	0.0	34.3	0.0	3.1	0.0	0.0	16.1	0.0	22.6

Area Source, ISO 9813, Name: "", ID: "I01!"																			
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
48	314233.40	5702742.91	20.22	0	DEN	500	72.0	24.8	0.0	0.0	0.0	31.6	0.0	2.5	0.0	0.0	17.4	0.0	-4.3
52	314233.34	5702743.13	20.23	0	DEN	500	72.0	10.7	0.0	0.0	0.0	31.6	0.0	2.5	0.0	0.0	17.4	0.0	9.7
58	314233.28	5702743.32	20.25	0	DEN	500	72.0	11.0	0.0	0.0	0.0	31.7	0.0	2.5	0.0	0.0	17.4	0.0	9.4
61	314233.23	5702743.47	20.25	0	DEN	500	72.0	-9.6	0.0	0.0	0.0	31.7	0.0	2.6	0.0	0.0	17.3	0.0	10.7
64	314233.16	5702743.68	20.27	0	DEN	500	72.0	-6.3	0.0	0.0	0.0	31.8	0.0	2.6	0.0	0.0	17.3	0.0	14.0
67	314233.09	5702743.88	20.28	0	DEN	500	72.0	-7.1	0.0	0.0	0.0	31.9	0.0	2.6	0.0	0.0	17.3	0.0	13.1
71	314232.99	5702744.15	20.29	0	DEN	500	72.0	-2.7	0.0	0.0	0.0	32.0	0.0	2.6	0.0	0.0	17.3	0.0	17.4
74	314232.86	5702744.48	20.31	0	DEN	500	72.0	-2.8	0.0	0.0	0.0	32.1	0.0	2.7	0.0	0.0	17.2	0.0	17.2
77	314232.79	5702744.68	20.32	0	DEN	500	72.0	-7.8	0.0	0.0	0.0	32.2	0.0	2.7	0.0	0.0	17.2	0.0	12.0
80	314232.70	5702744.86	20.33	0	DEN	500	72.0	-1.7	0.0	0.0	0.0	32.3	0.0	2.7	0.0	0.0	17.2	0.0	18.0
83	314232.62	5702745.05	20.34	0	DEN	500	72.0	-6.7	0.0	0.0	0.0	32.4	0.0	2.8	0.0	0.0	17.1	0.0	13.0
86	314232.52	5702745.25	20.35	0	DEN	500	72.0	-1.1	0.0	0.0	0.0	32.5	0.0	2.8	0.0	0.0	17.1	0.0	18.5
89	314232.32	5702745.68	20.37	0	DEN	500	72.0	2.1	0.0	0.0	0.0	32.7	0.0	2.9	0.0	0.0	17.0	0.0	21.5
93	314232.12	5702746.06	20.38	0	DEN	500	72.0	-0.9	0.0	0.0	0.0	32.9	0.0	2.9	0.0	0.0	16.6	0.0	18.6
97	314231.99	5702746.31	20.39	0	DEN	500	72.0	-0.7	0.0	0.0	0.0	33.0	0.0	3.0	0.0	0.0	16.4	0.0	18.8
101	314232.40	5702746.27	20.42	0	DEN	500	72.0	-8.7	0.0	0.0	0.0	32.7	0.0	2.9	0.0	0.0	16.9	0.0	10.7
105	314233.45	5702745.93	20.46	0	DEN	500	72.0	10.2	0.0	0.0	0.0	31.9	0.0	2.6	0.0	0.0	17.3	0.0	9.9
108	314233.30	5702742.91	20.22	0	DEN	500	72.0	21.3	0.0	0.0	0.0	31.7	0.0	2.5	0.0	0.0	17.4	0.0	-0.9
110	314232.77	5702743.18	20.20	0	DEN	500	72.0	-6.6	0.0	0.0	0.0	32.1	0.0	2.7	0.0	0.0	17.2	0.0	13.4
112	314232.24	5702743.43	20.19	0	DEN	500	72.0	-6.4	0.0	0.0	0.0	32.5	0.0	2.8	0.0	0.0	17.1	0.0	13.2
114	314231.79	5702743.64	20.18	0	DEN	500	72.0	-4.6	0.0	0.0	0.0	32.8	0.0	2.9	0.0	0.0	17.0	0.0	14.7
116	314231.05	5702743.97	20.15	0	DEN	500	72.0	-0.6	0.0	0.0	0.0	33.3	0.0	3.1	0.0	0.0	16.2	0.0	18.9
118	314230.60	5702744.17	20.14	0	DEN	500	72.0	19.2	0.0	0.0	0.0	33.6	0.0	3.2	0.0	0.0	15.7	0.0	0.4
120	314230.58	5702744.27	20.15	0	DEN	500	72.0	-1.6	0.0	0.0	0.0	33.6	0.0	3.2	0.0	0.0	15.6	0.0	18.0
122	314230.53	5702744.58	20.17	0	DEN	500	72.0	1.4	0.0	0.0	0.0	33.7	0.0	3.2	0.0	0.0	15.5	0.0	21.1
124	314230.46	5702744.98	20.19	0	DEN	500	72.0	-0.4	0.0	0.0	0.0	33.7	0.0	3.2	0.0	0.0	15.3	0.0	19.3
126	314230.41	5702745.20	20.20	0	DEN	500	72.0	-6.4	0.0	0.0	0.0	33.8	0.0	3.2	0.0	0.0	15.2	0.0	13.3
128	314230.36	5702745.42	20.22	0	DEN	500	72.0	-1.3	0.0	0.0	0.0	33.8	0.0	3.3	0.0	0.0	15.1	0.0	18.5
130	314230.30	5702745.65	20.23	0	DEN	500	72.0	-7.2	0.0	0.0	0.0	33.9	0.0	3.3	0.0	0.0	15.0	0.0	12.6
132	314230.25	5702745.86	20.24	0	DEN	500	72.0	-2.7	0.0	0.0	0.0	34.0	0.0	3.3	0.0	0.0	14.9	0.0	17.1
134	314230.12	5702746.31	20.27	0	DEN	500	72.0	-2.2	0.0	0.0	0.0	34.1	0.0	3.4	0.0	0.0	14.6	0.0	17.6
136	314229.97	5702746.78	20.29	0	DEN	500	72.0	-9.0	0.0	0.0	0.0	34.3	0.0	3.4	0.0	0.0	14.4	0.0	10.9
139	314229.88	5702747.02	20.31	0	DEN	500	72.0	13.9	0.0	0.0	0.0	34.4	0.0	3.5	0.0	0.0	14.2	0.0	6.0

vert. Area Source, ISO 9813, Name: "", ID: "I01!"																			
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
141	314234.32	5702745.19	22.96	0	DEN	500	72.0	0.3	0.0	3.0	0.0	30.5	0.0	0.1	0.0	0.0	19.7	0.0	24.9
143	314233.97	5702744.19	22.86	0	DEN	500	72.0	0.2	0.0	3.0	0.0	30.6	0.0	0.1	0.0	0.0	19.7	0.0	24.8
145	314233.64	5702743.21	22.78	0	DEN	500	72.0	0.1	0.0	3.0	0.0	30.8	0.0	0.1	0.0	0.0	19.6	0.0	24.5

vert. Area Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
148	314234.32	5702745.19	20.98	0	DEN	500	72.0	0.3	0.0	3.0	0.0	31.0	0.0	2.1	0.0	0.0	17.8	0.0	0.0	24.4
151	314233.97	5702744.19	20.88	0	DEN	500	72.0	0.2	0.0	3.0	0.0	31.1	0.0	2.2	0.0	0.0	17.7	0.0	0.0	24.2
154	314233.64	5702743.21	20.78	0	DEN	500	72.0	0.1	0.0	3.0	0.0	31.3	0.0	2.2	0.0	0.0	17.7	0.0	0.0	23.9
157	314234.32	5702745.19	21.98	0	DEN	500	72.0	0.3	0.0	3.0	0.0	30.7	0.0	0.9	0.0	0.0	19.0	0.0	0.0	24.7
159	314233.97	5702744.19	21.88	0	DEN	500	72.0	0.2	0.0	3.0	0.0	30.8	0.0	0.9	0.0	0.0	19.0	0.0	0.0	24.5
161	314233.64	5702743.21	21.78	0	DEN	500	72.0	0.1	0.0	3.0	0.0	31.0	0.0	0.9	0.0	0.0	19.0	0.0	0.0	24.2

vert. Area Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
163	314228.88	5702744.91	20.59	0	DEN	500	72.0	0.8	0.0	3.0	0.0	34.8	0.0	3.2	0.0	0.0	18.2	0.0	0.0	19.6
168	314229.32	5702746.12	20.70	0	DEN	500	72.0	1.8	0.0	3.0	0.0	34.5	0.0	3.1	0.0	0.0	18.1	0.0	0.0	20.8
170	314229.66	5702747.06	20.79	0	DEN	500	72.0	-2.6	0.0	3.0	0.0	34.4	0.0	3.1	0.0	0.0	18.1	0.0	0.0	16.7
173	314228.88	5702744.91	22.59	0	DEN	500	72.0	0.6	0.0	3.0	0.0	34.3	0.0	0.2	0.0	0.0	17.4	0.0	0.0	23.6
175	314229.32	5702746.12	22.70	0	DEN	500	72.0	1.8	0.0	3.0	0.0	34.2	0.0	0.2	0.0	0.0	17.1	0.0	0.0	24.9
177	314229.66	5702747.06	22.79	0	DEN	500	72.0	-2.6	0.0	3.0	0.0	34.2	0.0	0.2	0.0	0.0	17.0	0.0	0.0	21.0
179	314228.88	5702744.91	21.59	0	DEN	500	72.0	0.6	0.0	3.0	0.0	34.4	0.0	1.3	0.0	0.0	18.6	0.0	0.0	21.2
181	314229.32	5702746.12	21.70	0	DEN	500	72.0	1.8	0.0	3.0	0.0	34.3	0.0	1.3	0.0	0.0	18.5	0.0	0.0	22.4
183	314229.66	5702747.06	21.79	0	DEN	500	72.0	-2.6	0.0	3.0	0.0	34.3	0.0	1.3	0.0	0.0	18.5	0.0	0.0	18.4

Point Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
185	314231.72	5702746.55	25.41	0	DEN	500	74.5	0.0	0.0	0.0	0.0	32.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7

Point Source, ISO 9613, Name: "", ID: "I01!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
187	314230.62	5702746.96	25.38	0	DEN	500	74.5	0.0	0.0	0.0	0.0	33.6	0.0	0.0	0.0	0.0	5.3	0.0	0.0	35.6

Point Source, ISO 9613, Name: "", ID: "I00!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agrr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
189	314223.61	5702752.21	24.13	0	DEN	500	74.5	0.0	0.0	0.0	0.0	37.8	0.0	0.0	0.0	0.0	23.2	0.0	0.0	13.4

Point Source, ISO 9613, Name: "", ID: "I00!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
191	314224.06	5702753.32	24.13	0	DEN	500	74.5	0.0	0.0	0.0	0.0	37.9	0.0	0.0	0.0	0.0	23.1	0.0	0.0	13.5

Point Source, ISO 9613, Name: "", ID: "I00!"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
193	314224.51	5702754.45	24.13	0	DEN	500	74.5	0.0	0.0	0.0	0.0	38.0	0.0	0.0	0.0	0.0	23.1	0.0	0.0	13.4

Appendix E – Example Acoustic Fencing

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JAKOUSTIC® ABSORPTIVE

**Jacksons
Fencing**



Jakoustic® Absorptive acoustic fencing has the same interlocking V board construction as Jakoustic® Reflective, but has an additional absorptive layer on one side of the fence, made up of a mineral Rockwool fibre and protective membrane. It is ideal for applications where a noise source is in a tight confined area surrounded by other reflective surfaces.

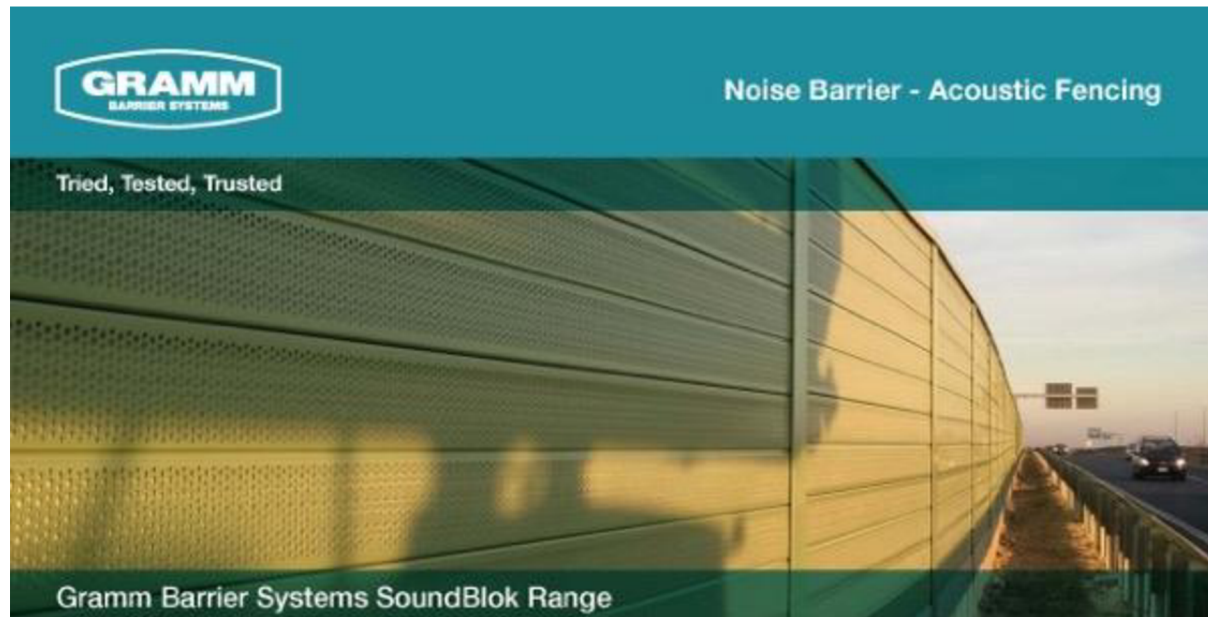
- Timber construction with planed boards visible on one face
- Unique tuning fork design posts
- Special fixings clamp the acoustic boards between posts
- Can accommodate changes in level or profile
- With timber capping and counter rail
- Jakoustic® fencing with an additional absorptive layer covered with a protective membrane
- Matching pedestrian, swing and tracked sliding gates
- Up to 32dB reduction in noise*
- High privacy barrier
- 25-year Jakcure® guarantee

*Jakoustic® Plus Absorptive Layer barrier certified laboratory results:

Category B3 rating according to BS EN 1793-2:1998

Category A3 rating according to BS EN 1793-1:1998

Laboratory sound reduction 32 dB Approximate Superficial Mass 28kg/m²



POLYSoundBlok® CE

ABSORPTIVE

Grammm Barriers POLYSoundBlok® Absorptive noise barrier systems are manufactured from high strength reinforced polymers. The strong maintenance free structure of the product makes it ideal for Road, Rail and Industrial projects.

Our system consists of highly durable rigid panels which, are rot proof with resistant to aggressive environments and compounds such as salt spray and oils all without the need for additional surface treatments throughout their operational life.



The materials of construction utilised in our POLYSoundBlok® Absorptive noise barrier systems are exceptionally durable, providing years of maintenance free performance without further treatment.

Grammm Barrier systems POLYSoundBlok® Absorptive barrier are constructed off site under strict quality controls providing the highest level of construction which conforms to all the latest standards required for all sectors.

Grammm Barriers POLYSoundBlok® Absorptive high-density composite surfaces in conjunction with high density mineral infill panels ensure consistent high acoustic performance throughout the length of the barrier. All designs are certified to the very latest European standards.

Applications



Road



Rail



Airport



Commercial



Industrial



Utilities



Ports



Defence



Residential



Housing