



Connell Co-op College, Manchester

Noise Assessment for Planning Condition Discharge – Verification Report

10th September 2021

inacoustic | **bristol**

Caswell Park, Caswell Lane, Clapton-in-Gordano, Bristol, BS20 7RT

0117 325 3949 | www.inacoustic.co.uk | bristol@inacoustic.co.uk

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Authored By	Lewis Wheatley BSc (Hons) AMIOA		
Reviewed By	Antony Best BSc (Hons) MIOA		
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1. INTRODUCTION

1.1. Overview

inacoustic has been commissioned to assess the impact of noise from a recently consented educational development site at Connell Co-op College, Manchester, Alan Turing Way, Manchester, M11 3BS.

The following verification noise assessment has been produced to provide supporting information to discharge planning conditions 16B, 17A and 17B of the decision notice referenced 128960/FO/2020 and is based upon predictive exercises and environmental noise measurements undertaken at the site.

This noise assessment is necessarily technical in nature; therefore a glossary of terms is included in Appendix A to assist the reader.

2. PLANNING CONDITIONS

The planning conditions associated with the decision notice referenced 128960/FO/2020, are stated below.

'16) b) Prior to occupation of the development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that acceptable criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

'17) a) Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location. Prior to any above ground works, a scheme shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site in regard to externally mounted ancillary plant and equipment.'

b) Prior to occupation of the development a verification report shall be submitted to and approved in writing by the City Council as local planning authority to validate that the 128960/FO/2020 Page 8 of 14 work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of non - conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

4. MEASUREMENTS

4.1. General

The location at which background sound measurements have been undertaken were chosen on the basis of being representative of the nearest noise-sensitive properties to the Consented Development.

The background sound measurements were carried out in accordance with BS4142:2014+A1:2019.

Attended background sound measurements were conducted during a typical midweek morning period at one location representative of the nearest noise sensitive properties to the Site, on 4th November 2020 between 10:00am-11:00am. It should be noted that measurements were taken during the COVID-19 lockdown.

Attended measurements taken of the plant noise and classroom noise breakout were measured on the 3rd September 2021.

The measurement location is discussed below in Table 1, with an aerial photograph indicating its location shown overleaf in Figure 2.

TABLE 1: MEASUREMENT POSITION DESCRIPTION

Measurement Position	Description
MP1	A free-field measurement of noise at the nearest noise sensitive properties. The microphone was located at a height of 1.5 metres above ground level. The ambient sound environment was influenced by road traffic noise from the nearby roads.
MP2	A free-field measurement at 1m away from the plant whilst in operation. The microphone was located at a height of 1.5 metres above ground level.
MP3	A reverberant internal sound level measurement within the classroom closest to the nearest residential property. Speakers playing pink noise were being played within the room to represent general classroom activity noise.
MP4	A measurement at 1m away from the classroom whilst in operation. The microphone was located at a height of 1.5 metres above ground level.
MP5	A free-field measurement of noise at the nearest noise sensitive properties, whilst the speakers were playing in the classroom. The purpose of the measurement was to determine effect of noise breakout from the classrooms on the nearest noise sensitive properties. The microphone was located at a height of 1.5 metres above ground level.

4.4. Equipment

The sound measurement exercise was undertaken by a consultant certified as competent in environmental sound monitoring, and, in accordance with the principles of BS 7445¹ and following the guidance given in BS4142:2014+A1:2019.

The acoustic measurement equipment used during the sound survey conformed to Type 1 specification of British Standard 61672². A full inventory of this equipment is shown in Table 2 below:

TABLE 2: INVENTORY OF SOUND MEASUREMENT EQUIPMENT

Position	Make, Model & Description	Serial Number
MP1	Rion NL-32 Sound Level Meter	01213696
	Rion NH-21 Preamplifier	36327
	Rion UC-53A Microphone	318715
MP2, MP4 and MP5	Rion NL-52 Sound Level Meter	00943282
	Rion NH-25 Preamplifier	43298
	Rion UC-59 Microphone	07045
MP3	Rion NL-52 Sound Level Meter	00764926
	Rion NH-25 Preamplifier	76427
	Rion UC-59 Microphone	12922
All	Cirrus CR:515 Acoustic Calibrator	80029

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.1 dB in the field calibration was found to have occurred on the sound level meter. The microphone was fitted with a protective windshield for the entire measurement period.

¹ British Standard 7445: 2003: *Description and measurement of environmental noise*. BSI

² British Standard 61672: 2013: *Electroacoustics. Sound level meters. Part 1 Specifications*. BSI.

4.5. Sound Survey Results

4.5.1. Background Sound Measurements

The summarised results of the environmental noise measurements, during the daytime period, can be seen below in Table 3.

TABLE 3: BACKGROUND SOUND MEASUREMENT RESULTS

Measurement Position	Period	Noise Level, dB			
		L _{Aeq}	L _{AFmax}	L _{A10}	L _{A90}
MP1	Day 10:00-11:00	55.8	74.6	58.7	47.7

4.5.2. Measurements of Plant Noise

The summarised results of the plant noise measurements, during the standard operating duty, can be seen below in Table 4.

TABLE 4: PLANT NOISE MEASUREMENT RESULTS

Measurement Position	Period	Noise Level, dB			
		L _{Aeq}	L _{AFmax}	L _{A10}	L _{A90}
MP2	Plant On at 1m	56.0	58.2	56.3	55.6

4.5.3. Classroom Noise Breakout Measurements

The summarised results of the environmental noise measurements taken to assess classroom noise breakout, during the daytime period, can be seen below in Table 5.

TABLE 5: CLASSROOM BREAKOUT MEASUREMENT RESULTS

Measurement Position	Period	Noise Level, dB			
		L _{Aeq,T}	L _{AFmax}	L _{A10}	L _{A90}
MP3	Measurement within Classroom w/Noise On 14:15-14:27	99.8	100.6	100.1	98.1
	Measurement within Classroom w/Noise Off 14:28-14:39	42.0	62.1	42.2	39.2
MP4	1m from Window w/Speakers On 14:17-14:19	80.4	82.2	80.8	79.9
	1m from Window w/Speakers Off 14:17-14:19	48.8	55.3	49.6	47.2
MP5	Measurement at NSR w/Speakers On 14:21-14:26	63.2	76.7	63.4	51.8

	Measurement at NSR w/Speakers Off 14:32-14:37	63.7	77.6	63.7	50.4
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5. NOISE ASSESSMENT

5.1. Noise Breakout Assessment from Classrooms (Condition 16A)

5.1.1. Assessment Methodology & Approach

The methodology adopted for this assessment has been based on determining a representative baseline noise climate for the nearest noise-sensitive receptors to the recently constructed building and assessing the impact of noise generated from the consented classrooms on those receptors.

Measurements have been taken within the classroom, whilst noise is generated to represent general activity noise and representative measurements have been taken at the nearest noise sensitive receptors to determine the impact of noise. Measurements have been taken with the windows open to represent a worst-case scenario.

It was noted that whilst on site, that the specific sound level associated with the noise breakout from the classroom at the nearest noise sensitive receptor, was completely inaudible against the residual sound environment. However, a demonstration of the measured levels show that the noise generated from the classrooms was immeasurable at the nearest noise-sensitive receptors, as would be expected.

5.1.2. Background Information

Pink Noise has been generated within the recently constructed classroom, with the windows fully open. The reverberant internal sound pressure level is detailed below:

- Reverberant L_p 99.8 dB(A)

Noise levels from such developments are likely to be highly variable. This data set is viewed as a robust basis for the assessment, providing a substantiated worst-case noise generation statistic, which are verifiable and repeatable.

Measurements of received noise levels have been undertaken at the closest receptor points along Wilson Street to the south of the site.

5.1.3. Measurements of Noise Breakout – Relative Change in Ambient Noise Level

The closest classroom to the nearest residential receptor along Wilson Street has been measured to be 110m away. The measured ambient sound levels from the classroom noise breakout can be seen below in Table 6.

TABLE 6: PREDICTED SPECIFIC SOUND LEVELS AT THE NEAREST NOISE SENSITIVE RECEPTORS

Location	Measured Ambient Sound Level dB(A)
Measurement at NSR1 with Speakers On 14:21-14:26	63.2
Measurement at NSR1 with Speakers Off 14:32-14:37	63.7

The measurements detailed in in Table 6 above identifies that under worst-case, peak use conditions, with windows open, identify that there is *No Change* in the ambient sound environment at the nearest noise sensitive receptor and would be classed as NOEL in accordance with NPPG for Noise, England.

It was noted on site, that noise contributions from noise breakout associated with the classroom was inaudible against the residual sound environment.

5.2. Plant Noise Assessment (Condition 17A and 17B)

5.2.1. Methodology

Measurements have been taken of the recently installed plant to determine the level of impact of plant noise upon the nearest noise sensitive receptors. The predicted rating sound level from the plant will be compared against the previously measured background sound level, to determine if compliance with the Council's requirement that the rating level must be 5dB below the typical background (L_{A90}) level at the nearest noise sensitive location can be achieved. Due to the measured sound levels associated with the plant being so low, the data must be extrapolated to determine a specific sound level at the nearest noise sensitive receptor, in accordance with the principles of BS4142:2014+A1:2019.

5.2.2. Source Data

The A-weighted sound source data associated with the recently installed condenser units, based on measurements taken on site, whilst the plant was operating at its design duty, can be seen below in Table 7.

TABLE 7: SOUND POWER LEVEL SOURCE DATA

Measurement Position	Fan Model	Sound Pressure Level dB(A)
MP1	Daikin REYQ16T Condenser Unit	56 at 1m
	Daikin REYQ20T Condenser Unit	

5.2.3. Specific Sound Level Summary

The fan has been measured to be 110 metres away from the nearest noise sensitive receptor. The calculated specific sound level at the nearest noise sensitive receptor is set out in Table 8 and is based entirely on distance loss attenuation. The calculations do not consider any other environmental corrections such as humidity, ground absorption, screening from buildings etc, which would only reduce the specific sound level further.

TABLE 8: PREDICTED SPECIFIC SOUND LEVEL SUMMARY

Position	Specific Sound Level dB(A)
NSR1	15

5.3. Assessment

5.3.1. Rating Penalty Principle

Section 9 of BS4142:2014+A1:2019 describes how the rating sound level should be derived from the specific sound level, by determining a rating penalty.

BS4142:2014+A1:2019 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 Consented 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 BS4142:2014+A1:2019, 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.”

BS4142:2014+A1:2019 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”*.

Other Sound Characteristics

BS4142:2014+A1:2019 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.”*

Intermittency

BS4142:2014+A1:2019 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.”*

5.3.2. Rating Penalty Assessment

Considering the content of Section 5.3.1, an assessment of the various sound sources associated with the Consented Development, in terms of whether any rating penalties are applicable, and has been detailed in Table 9 below.

TABLE 9: RATING PENALTY ASSESSMENT

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
Condenser Units (Daytime)	0 dB	0 dB	+3 dB	0 dB	The proposed plant is likely to run intermittently on demand. Therefore, a correction for intermittency has been applied.

In summary, a rating penalty of +3 dB has been included in the assessment.

5.3.3. Uncertainty in Calculations

BS4142:2014+A1:2019 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

BS4142:2014+A1:2019 states that measurement uncertainty depends on a number of factors, including the following, which are applicable to the Consented 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 10 below.

TABLE 10: 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	Measuring at locations representative of the closest affected receptors to the site has enabled the determination of robust background sound levels.
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 taken during a daytime period when the plant is likely to be operating.
i)	0 dB	No periods of significant wind or precipitation were measured.
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.

In summary, a correction of 0 dB has been included in the assessment, to account for measurement uncertainty.

Calculation Uncertainty

BS4142:2014+A1:2019 states that calculation uncertainty depends on a number of factors, including the following, which are applicable to the Consented 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 11 below.

TABLE 11: CALCULATION UNCERTAINTY FACTORS

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Simple design, therefore no uncertainty associated with characteristics, and manufacturers data used for plant equipment.
c)	0 dB	Calculations were undertaken in accordance with ISO 9613-2, which is considered a “ <i>validated method</i> ” by BS4142:2014+A1:2019.
d)	+1 dB	The real situation has been simplified for the purposes of this assessment.
e)	0 dB	ISO 9613-2 indicates that there is a ± 3 dB accuracy to the prediction method, however, the calculations are based on the simplest scenario, with no additional corrections for; air absorption; ground absorption; screening; or meteorological conditions.

In summary, a +1 dB has been included in the assessment, for calculation uncertainty.

5.4. Rating Sound Level

Incorporating the rating penalties detailed in Section 5.2.2 with the predicted specific sound levels, as detailed in Table 8, the rating sound levels have been derived and have been detailed in Table 12 below.

TABLE 12: RATING SOUND LEVELS

NSR	Specific Sound Level (dB)	Rating Sound Level (dB)
		Day
1	15	18

5.4.1. BS4142:2014+A1:2019 Assessment

The rating sound level, as calculated from the predicted specific sound level, has been assessed in accordance with BS4142:2014+A1:2019, at all NSRs.

The resultant assessment summary, during the daytime period, can be seen in Table 13 below.

TABLE 13: DAYTIME BS4142:2014+A1:2019 ASSESSMENT SUMMARY

NSR	Rating Sound Level (dB)	Uncertainty (dB)	Daytime Background Sound Level (dB)	Excess of Rating over Daytime Background Sound Level (dB)
1	18	+1	48	-29

It can be seen that the Consented Development is likely to have a '*low impact*' at the receptors during the daytime period and complies with the requirement which specifies that the rating level must be 5dB below the typical background (L_{A90}) level at the nearest noise sensitive location.

6. CONCLUSION

inacoustic has been commissioned to assess the impact of noise from a recently consented educational development site at Connell Co-op College, Manchester, Alan Turing Way, Manchester, M11 3BS.

The following technical noise assessment has been produced to provide supporting information to discharge planning conditions 16B, 17A and 17B of the decision notice referenced 128960/FO/2020 and is based upon predictive exercises and environmental noise measurements undertaken at the site.

In light of the above, it is considered that planning condition 16B, 17A and 17B can be discharged.

7. APPENDICES

7.1. Appendix A – Definition of Terms

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 20 μ Pa (20 $\times 10^{-6}$ 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 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 μ Pa.
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 14: 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).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1\text{hour}}$ dB and $L_{A90,15\text{mins}}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

inacoustic | **bristol**

Caswell Park, Caswell Lane, Clapton-in-Gordano, Bristol, BS20 7RT

0117 325 3949 bristol@inacoustic.co.uk

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