

Acoustic Consultancy Report

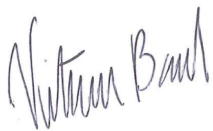
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Co-op Caversham Final Report

Report Prepared For

Box Clever Engineering Ltd
The Co-Operative Food
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Report Author



Victoria Bond BSc MIOA (D)

Checked By



M Balsom MSc MIOA (D) (E)

Telephone

0118 918 6460

Facsimile

0118 918 6480

enquiries@lcpacoustics.co.uk
www.lcpacoustics.co.uk

LCP

Riverside House
3 Winnersh Fields
Gazelle Close
Winnersh
Wokingham
RG41 5QS

A division of CAICE

Acoustic Air Movement Ltd.

Company Registration Number

2790667

VAT Registration Number

GB614683632

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i) Executive Summary

New mechanical plant is to be installed at Co-op Caversham, 124 Henley Road, Caversham, Reading, Berkshire, RG4 6DH.

LCP has been commissioned by Box Clever Engineering Ltd to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The design criteria are as follows:

Day: 38 dB $L_{Aeq, T}$ at 13m, at the façade of the nearest noise sensitive properties.

Night: 26 dB $L_{Aeq, T}$ at 13m, at the façade of the nearest noise sensitive properties.

The design as proposed and assessed, including the mitigation specified in section 5 of this report, will achieve the required criteria; the calculated rating levels are as follows:

Day: 24 dB $L_{Aeq, T}$ at 13m, at the façade of the nearest noise sensitive properties.

Night: 24 dB $L_{Aeq, T}$ at 13m, at the façade of the nearest noise sensitive properties.

This report concludes that the design criteria can be achieved.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	11 th November 2015	Initial Issue	BC	-
2	24 th February 2016	Minor amendment	VB	MB
3	25 th February 2016	Minor amendment	VB	MB

1 Introduction

New mechanical plant is to be installed at Co-op Caversham, 124 Henley Road, Caversham, Reading, Berkshire, RG4 6DH.

LCP has been commissioned by Box Clever Engineering Ltd to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The report details recommendations for necessary noise mitigation where necessary.

The guidance contained in this report is given on the basis that the operational period of the plant may be continuous at any time.

2 Survey

A noise survey of the area was carried out by Box Clever Engineering Ltd between Thursday 9th and Friday 10th October 2014. The results of the survey can be viewed in their report no. BC010013 titled Caversham Acoustic Criterion Report.

The measured statistical broad-band sound pressure levels obtained in that report are as follows:

Table 1: Representative background sound levels, dB re 2×10^{-5} Pa

Measurement Position	L _{A90} Day*	L _{A90} Night*
MP1	48	36

* Day and night periods are defined as between 07:00 - 23:00 and 23:00 - 07:00 respectively.

3 Evaluation of Design Criteria

3.1.1 Council Enforced Criteria Limits

The Box Clever report BC010013 reports the council enforced criteria to be as follows:

“Reading Borough Council will only accept -10 dB at Night.

Have taken the point to appeal and won. Will usually accept -5 dB during the daytime.”

3.1.2 Recommended Residential Design Rating Level

On the basis of the above the recommended residential design rating level should therefore be:

Residential Design Sound Emission Level
Representative L _{A90} - 10 dB

3.2 Design Rating Levels

The design levels to be adopted for this project are set out in the table below.

Table 2: Design rating levels, dB re 2×10^{-5} Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, T \text{ hr}}$ (dB)	Design Level (Night) $L_{Aeq, T \text{ hr}}$ (dB)
Flats above the store	13	38	26

4 Review of Current Design

4.1 Current Design

All existing plant is to be retained without modification.

One new J & E Hall JEHS-0500-L-3 unit is to be installed close to the southern corner of the existing store.

The new plant unit will potentially operate continuously 24 hours per day.

4.2 Calculated Results

Calculations of the predicted noise levels have been carried out with the appropriate corrections for geometric attenuation, barrier effect, reflective surfaces and multiple source addition.

The design rating levels to be adopted for this project, together with the predicted noise levels, are set out in the table below. Where the existing level exceeds the design level then this has been considered to replace the design level.

Table 3: Design and predicted rating levels, dB re 2×10^{-5} Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 16 \text{ hr}}$	Design Level (Night) $L_{Aeq, T \text{ hr}}$ (dB)	Predicted Level $L_{Aeq, T}$
Flats to the South above the store	13	38	26	34

Plant noise level data used in this assessment are contained within Appendix B.

5 Noise Mitigation Options

As the plant installation has been assessed to be over the required criteria at the surrounding noise sensitive receptors, the following option shall be applied in order that noise emissions are reduced to not exceed existing levels.

Should the plant installation be redesigned after consideration of the mitigation options, the installation shall be re-assessed to ensure compliance to the specification has been achieved.

5.1 Noise Mitigation Scheme

The suggested mitigation measure is the introduction of a suitable noise mitigation scheme by means of a full acoustic enclosure. The required insertion loss of the enclosure is shown in the table below.

Table 4: Required acoustic enclosure performance, dB

	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Acoustic Enclosure	8	10	10	19	22	27	28

Should this option be implemented, the design of the mitigation will need the services of a noise control company specialising in bespoke solutions to non-standard situations.

Such a company would visit the site and attempt to arrive at an economic solution, taking into account all the parameters of this particular situation.

The problems of air flow, pressure drop etc. applicable to this equipment will all need to be taken into account.

5.2 Mitigated Results

The design rating levels to be adopted for this project, together with the predicted noise levels inclusive of the mitigation detailed in Section 5, are set out in the table below.

Table 5: Design and predicted mitigated rating levels, dB re 2×10^{-5} Pa

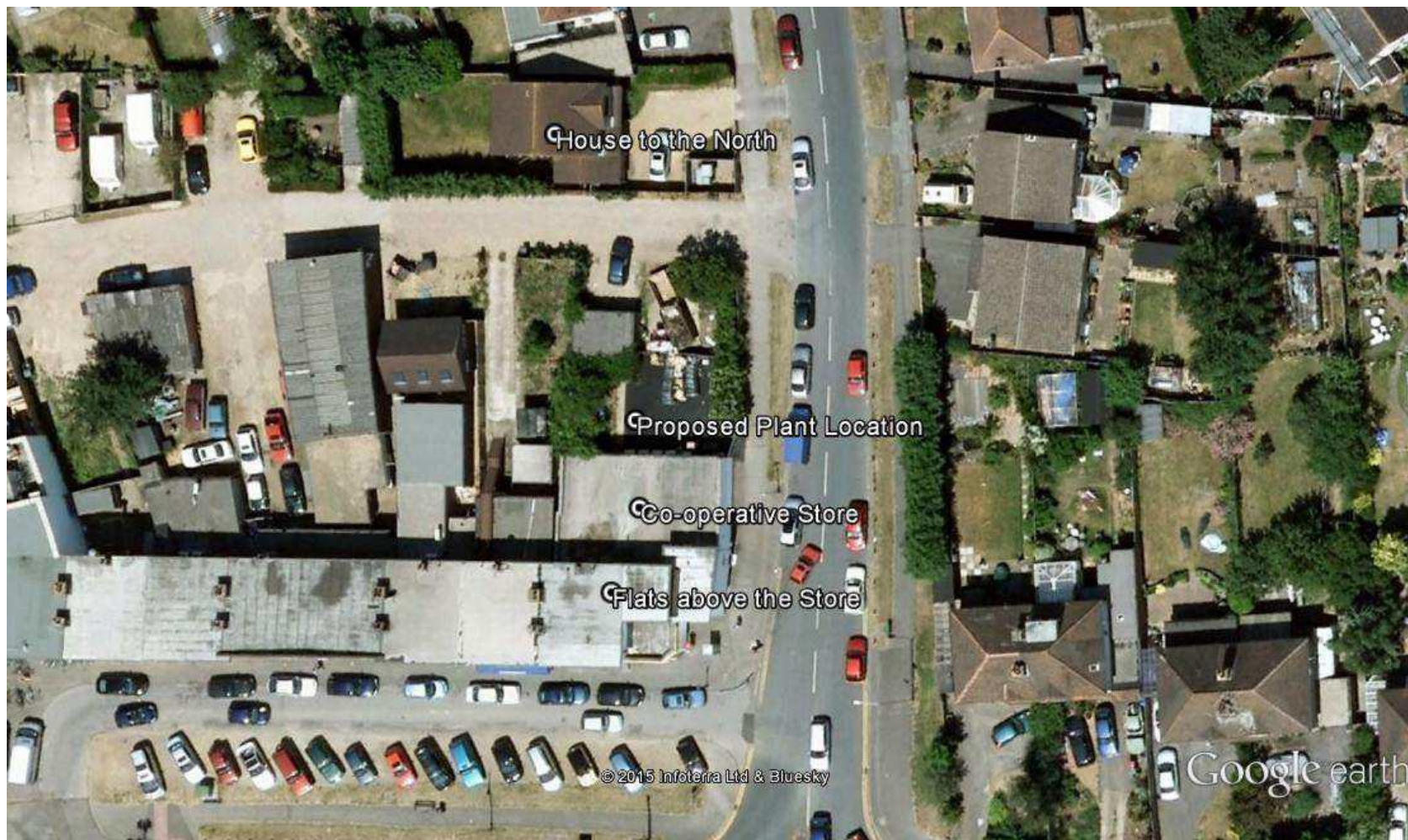
Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 16 \text{ hr}}$	Design Level (Night) $L_{Aeq, T \text{ hr}}$ (dB)	Predicted Level $L_{Aeq, T}$
Flats to the South above the store	13	38	26	24

Calculations are shown within Appendix C.

6 Conclusion

An environmental noise survey has been undertaken in order to establish the representative background sound levels local to the site generally in accordance with the method contained within BS4142: 2014. Calculations have been carried out to determine the noise levels at the nearest receiver premises. The calculations show that with the mitigation specified in Section 5 of this report implemented, the design criteria will be met.

Appendix A: Site Plan



Appendix B: Plant Data

Plant noise data used in the preceding assessment follow.

Table 6: Manufacturer's plant sound pressure data, dB re 2×10^{-5} Pa

Plant	Distance (m)	Octave Band Centre Frequency (Hz)							L _{PA}
		125	250	500	1k	2k	4k	8k	
J & E Hall JEHS-0500-L-3	1	68	61	47	45	41	35	31	56

Appendix C: Calculations

Project Information:

Project Number	71788
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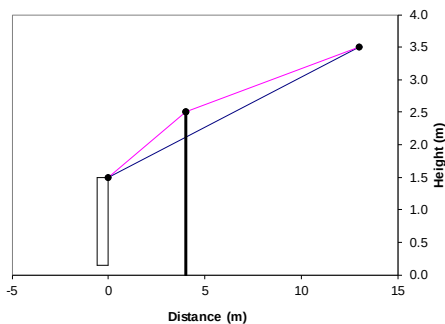
Calculation Information:

Source Description	JE & Hall JEHS-0500-L-3 unit
Receiver Description	Flats Above

Source Dimensions:

Description	Value	Units
Source height (dimension a) (1)	1.3	m
Source length (dimension b) (1)	0.9	m
Source depth	0.6	m

Plant and Barrier Layout:



Barrier Loss:

Description	Value	Units
Source height (2)	1.5	m
Receiver height	3.5	m
Barrier height	2.5	m
Source to barrier distance	4.0	m
Barrier to receiver distance	9.0	m
Calculated path difference	0.03	m

Reference level is base of barrier

Distance to Receiver:

Description	Value	Units
Barrier Present	Y	
Distance to Receiver (no barrier) (3)		m

Barrier Acoustic Details:

Description		Octave Band Centre Frequency (Hz)								Rw	Units	Ref
		63	125	250	500	1000	2000	4000	8000			
Barrier Sound Reduction Index	Unknown	100	100	100	100	100	100	100	100	101	dB	
Barrier Attenuation (4)		-5	-5	-6	-7	-8	-10	-12	-14			
Deration		0	0	0	0	0	0	0	0			
Net Barrier Loss		-5	-5	-6	-7	-8	-10	-12	-14			

Calculated Noise Level at Receiver:

Description				Octave Band Centre Frequency (Hz)								A	Units	Ref
				63	125	250	500	1000	2000	4000	8000			
Source Noise Data (Lp) (5)	Reference distance	1.0	m		68	61	47	45	41	35	31	56	dB	
Calculated Source Lw (6)				9	77	69	56	54	49	44	40	65	dB	1
Distance Attenuation (from Lw)	Distance to receiver	13.2	m	-30	-30	-30	-30	-30	-30	-30	-30		dB	1
Net Barrier Loss				-5	-5	-6	-7	-8	-10	-12	-14		dB	2,3
Reflections (7)		1		3	3	3	3	3	3	3	3		dB	3
Number of sources		1		0	0	0	0	0	0	0	0		dB	3
Façade Correction (3dB) (8)				3	3	3	3	3	3	3	3		dB	
Noise Level at Receiver (Lp)				-21	47	39	25	21	15	8	1	34	dB	

Required Criteria:

Description	Criteria Type	Value		Octave Band Centre Frequency (Hz)								A	Units	Ref
				63	125	250	500	1000	2000	4000	8000			
Limiting Noise Criteria	dBA	26		46	35	26	20	16	13	11	9	26	dB	
Excess					12	13	5	5	2			9	dB	

Suggested Noise Mitigation (9)

Additional Noise Reduction (e.g. enclosure)				Octave Band Centre Frequency (Hz)								A	Units	Ref
				63	125	250	500	1000	2000	4000	8000			
Noise Reduction Loss (10)	Manual			-8	-10	-10	-19	-22	-27	-28	-20		dB	
Resultant Noise Level				0	37	29	6	0	0	0	0	24	dB	
Remaining Excess					2	3							dB	

Reference 1	"Note on two common problems of sound propagation"	E.J. Rathe	Journal of Sound and Vibration	1969
Reference 2	"Calculation of Road Traffic Noise"		Department of Transport	1988
Reference 3	IOA Diploma Formula Sheet Edition 5			2003

Appendix D: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB $\neq$ 60 dB

30 dB + 30 dB = 33 dB

$D_{nTw} + C_{tr}$

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply $L1 - L2$.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.

C_{tr}

Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf} , RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to 2×10^{-5} Pa.

Subjective Effect of Changes in Sound Pressure Level

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.