

Deliveroo

Unit 57 Milford Road
Reading
RG1 8LG

Noise Impact Assessment

On behalf of



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1.0 Introduction

- 1.1. A Deliveroo kitchen is to be located in an industrial unit at 57 Milford Road, Reading.
- 1.2. Noise Solutions Ltd (NSL) has been commissioned to undertake a noise impact assessment in relation to the plant noise emissions from the building services plant serving the proposed kitchen.
- 1.3. Noise emission levels for the proposed plant have been predicted at the nearest noise sensitive receptors to the site and assessed against the relevant local and national guidance.
- 1.4. [Appendix A](#) contains a guide to common acoustic terminology.

2.0 Details of development proposals

- 2.1. A Deliveroo kitchen will be located at unit 57 Milford Road, in Reading. The proposals include for the installation of two supply Air Handling Units (AHU), six kitchen extract fans and three smaller general extract fans (2xK100L + 1xK315L). In addition, 3 catering condensing units will be located externally.
- 2.2. All ventilation will be located inside the building with external intake and discharge vents. The kitchen extract and the supply systems will penetrate through the south elevation of the building, at ground floor level. The general extract system (K315L), will also discharge at the south elevation of the building, but at first floor level.
- 2.3. The two small extract systems serving the toilets (K100L) will discharge through two apertures located at the north elevation of the building.
- 2.4. Finally, three catering condensing units will be located externally, in the south elevation of the building under the kitchen extract ventilation apertures.
- 2.5. The proposed extract and supply systems will operate only between 11.00 and 23.00 hours daily. Only the catering condensing units will operate continuously. [Appendix D](#) contains the noise output data for the proposed plant.

3.0 Nearest noise sensitive receptors

- 3.1. The area surrounding the site is essentially industrial in use, with the nearest houses (Reference R1) on Cardiff Road, to the south of the site. In addition to noise from the unit to the rear windows of the houses (R1.1), noise within the rear gardens (R1.2) has been assessed.

- 3.2. [Appendix B](#) contains an aerial photograph showing the site and surrounding area.

4.0 Existing noise climate

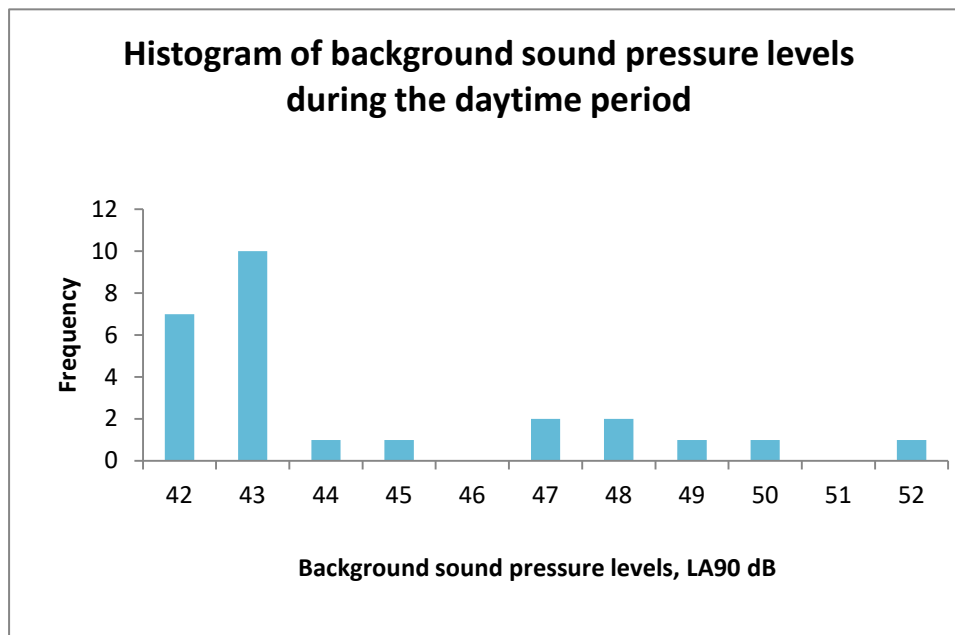
- 4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.
- 4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in [Appendix C](#).

Table 1: Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15min)	L _{Amax} (15min)	L _{A10} (15min)	L _{A90} (15min)
Daytime (07.00 - 23.00 hours)	48-64	69-93	48-66	42-52
Night-time (23.00 - 07.00 hours)	43-57	53-77	44-59	40-46

- 4.3. The background sound levels for both the daytime and night-time periods were assessed using statistical analysis of the measured L_{A90,15min} values.
- 4.4. The results of the analysis of the measured L_{A90,15min} values during the daytime period are shown in the histogram below.

Figure 1 Histogram of background daytime sound pressure levels



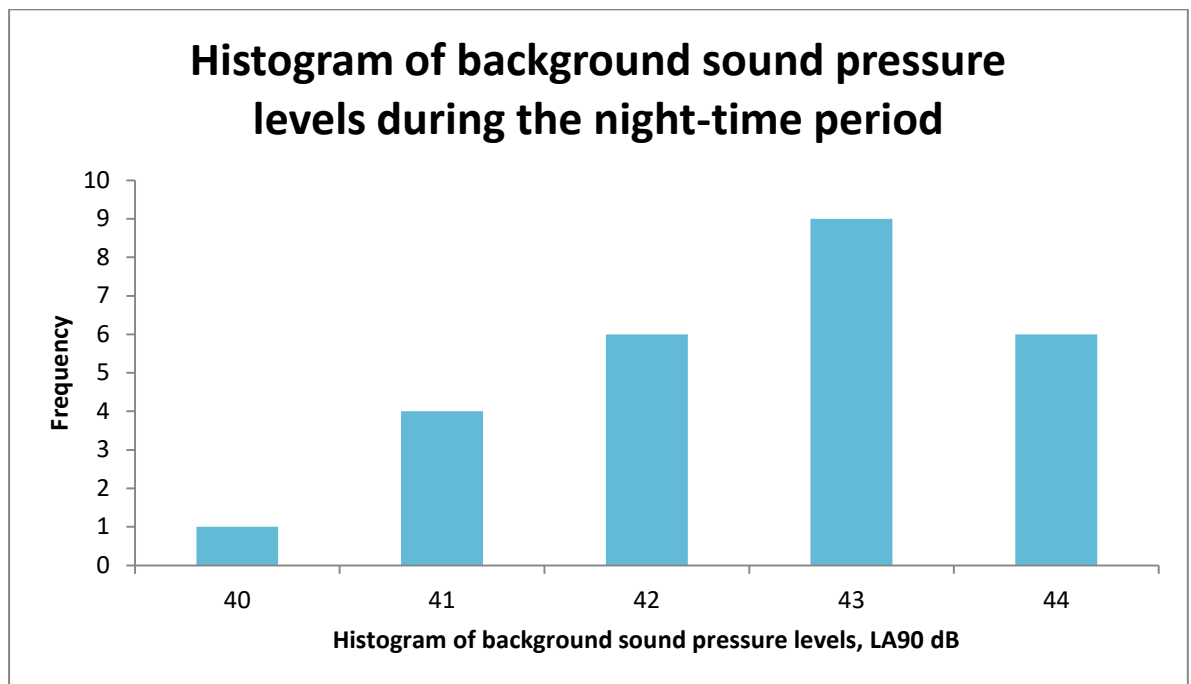
- 4.5. Additional statistical analysis has been undertaken. As shown in Table 2, below, the mean, median, and modal values have been calculated:

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
Mean	44
Median	43
Mode	43

- 4.6. The mean, median and mode values range between 43dB L_{A90} and 44dB L_{A90} . It is reasonable to consider the lowest of those values as representative of the background sound pressure levels during the daytime period at of the nearest noise sensitive receptors to the proposed plant.
- 4.7. The statistical analysis of the results of the measured $L_{A90,15min}$ during the night-time period can be seen in the histogram below.

Figure 2 Histogram of background night-time sound pressure levels



- 4.8. Additional statistical analysis has been undertaken. As shown in Table 3 below the mean, median, and modal values have been calculated:

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
Mean	43
Median	43
Mode	43

- 4.9. The mean, median and modal values range are 43dB L_{A90} . Review of the histogram indicates that the background sound level is only rarely below 41 dB L_{A90} . To give a robust assessment, this is selected as representative of the night-time noise background sound level.
- 4.10. Therefore, the following values are considered as representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 43dB L_{90} during the daytime period; and
 - 41dB L_{90} during the night-time period.

5.0 Legislative framework

Reading Borough Council

5.1. Reading Borough Council typical requirements in regards of plant noise emissions is unknown. As a consequence, the assessment provided in this report has been based in the guidance provided in the following legislative documents and standards:

- Noise Policy Statement for England
- National Planning Policy Framework (NPPF)
- BS 8233:2014 *'Guidance on Sound Insulation and Noise Reduction for Buildings'*
- BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'*

Noise Policy Statement for England

5.2. The Noise Policy Statement for England (NPSE), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are: *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

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

5.3. The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and quality of life occur.

5.4. The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the NPSE). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case: *"...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."*

5.5. Importantly, the NPSE goes on to state: "This does not mean that such adverse effects cannot occur."

- 5.6. The NPSE does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that: *"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*
- 5.7. It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

National Planning Policy Framework

- 5.8. The National Planning Policy Framework (NPPF) was introduced in March 2012. The document sets out the Government's planning policies for England and how these are expected to be applied.
- 5.9. *Paragraph 123 of the NPPF states that planning policies and decisions should aim to:*
- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
 - *mitigate and reduce to a minimum other adverse impacts on quality of life arising from noise from new development, including through the use of conditions;*
 - *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established [subject to the provisions of the Environmental Protection Act 1990 and other relevant law]; and*
 - *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*
- 5.10. Furthermore the NPPF gives weight to the requirements of the local authority as it states the following:

11. Planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise.

12. This National Planning Policy Framework does not change the statutory status of the development plan as the starting point for decision making. Proposed development that accords with an up-to-date Local Plan should be approved, and proposed development that conflicts should be refused unless other material considerations indicate otherwise. It is highly desirable that local planning authorities should have an up-to-date plan in place.

13. The National Planning Policy Framework constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications.

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

- 5.11. BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999). These guideline noise levels are shown in Table 4, below.

Table 4 Indoor ambient noise levels for dwellings.

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

- 5.12. BS8233 also gives general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states that:

'If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15dB.'

- 5.13. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15dB should be applied to the whole façade. Therefore, plant noise emissions not exceeding a noise level of 50dB during the daytime period and 45dB during the night-time period would ensure compliance with the above requirements.

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

- 5.14. BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes "sound from fixed plant installations which comprise mechanical and electrical plant and equipment". The standard has been referenced as appropriate for the assessment of noise from plant.
- 5.15. The procedure contained in BS 4142:2014 provides the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise

levels. Where the noise contains *"a tone, impulse or other characteristic"* then various corrections can be added to the specific (source) noise level to obtain the *"rating level"*.

5.16. The likely effects of sound on people are assessed by subtracting the background noise level from the rating level. BS 4142:2014 states the following:

- *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 is likely to be an indication of an adverse impact, depending on the context;*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

5.17. A design criterion based on limiting the plant noise rating level to a level which does not exceed the background noise levels during the both the daytime and night-time periods is considered appropriate for this site.

5.18. Based on the above, plant noise rating levels at nearby noise sensitive windows should not exceed 43dB L_{Aeq} during neither the daytime or night-time period;

5.19. Compliance with that criterion also means that the internal noise levels considering openable windows for natural ventilation are around 7dB and 2dB below the requirements in BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' during the daytime and night-time periods, respectively.

Criterion at garden

5.20. The gardens of the premises along Cardiff Road will also be affected by the noise emissions from the kitchen and, therefore, an additional noise criterion has been defined for external amenity spaces. The criterion is based on the guidelines established in section 7.7.3.2 'Design criteria for external noise' of BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings', which states:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper

guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

- 5.21. Based on the above, plant noise levels at the gardens of the nearest residential premises to the Deliveroo kitchen should not exceed 50dB L_{Aeq} during the daytime period. No noise target has been imposed at the amenity space during the night-time period.

6.0 Plant Noise assessment

- 6.1. Cumulative noise emissions from the proposed plant have been predicted at the nearest properties to the site based on the manufacturer's noise data presented in [Appendix D](#).
- 6.2. Noise levels for the proposed extract and supply systems have been predicted taking into account ductwork system losses, aperture size, directivity of sound propagation, distance attenuation and screening from the building envelope. Predictions are inclusive of the following atmospheric-side attenuation fitted to the ventilation systems.

Table 5 Proposed atmospheric-side attenuator selections

Attenuator	Insertion loss (dB) at Octave Band Centre Frequencies (Hz)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Kitchen extract systems	4	8	16	24	31	25	18	10
Supply systems	4	6	11	19	25	17	11	7

- 6.3. The proposed fans are high-quality systems which will run continuously between 11.00 and 23.00 hours. The fans will not emit any impulsive characteristics provided they are well maintained. Although the manufacturer's do not provide 1/3 octave band frequency data to enable a full tonal analysis in accordance with the methodology detailed in BS 4142:2014, a review of the 1/1 octave band data in [Appendix D](#) does not suggest the presence of any tonal peaks. Therefore, no feature correction has been applied to the predicted noise levels.

- 6.4. Predicted noise levels during the daytime period (specifically between 11.00 and 23.00 hours when the plant will be in operation) are based upon all plant operating simultaneously at maximum capacity. All the ventilation plant will be switched off between 23.00 and 11.00 hours when the kitchen is closed and only the catering condensing units for the coldrooms will be operative at that interval.
- 6.5. Table 6, below, summarises the assessment of predicted noise levels. The full set of calculations are presented in [Appendix E](#).

Table 6 Assessment of predicted noise levels at the nearest noise sensitive receptors

Receptor	Period	Predicted noise level at receptor, L_{Aeq} (dB)	Design criterion (dB)	Difference (dB)
Receptor R1.1. Residential premises at Cardiff Road. Windows	All plant operating (11.00 - 23.00 hours)	42	43	-1
	Catering condensing units operating (11.00 - 23.00 hours)	24	41	-17
Receptor R1.1. Residential premises at Cardiff Road. Garden	All plant operating (11.00 - 23.00 hours)	45	50	-5
	Catering condensing units operating (11.00 - 23.00 hours)	27	N/A	-

- 6.6. The plant noise impact assessment has demonstrated that cumulative noise emissions from the proposed plant will comply with the proposed requirements established following the guidance provided in the Noise Policy Statement for England, the National Planning Policy Framework (NPPF), BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' and BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'.
- 6.7. Where possible uncertainty in this assessment has been minimised by taking the following steps:
- The measurement of the background sound levels was undertaken at a representative location, within close proximity of the nearest noise sensitive receptors with comparable distance and screening to local noise sources.
 - The meter and calibrator used have a traceable laboratory calibration and was field calibrated before and after the measurements.
 - Uncertainty in the calculated impact has been reduced by the use of a well-established calculation method.

-
- 6.8. All reasonable steps have been taken to robustly assess noise from the proposed plant. In support of the above assessment, noise from fixed plant can be considered of 'low impact' in accordance with BS 4142:2014. It should be noted that all reasonable steps have been taken to reduce noise emissions from the proposed plant installations.

7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned by Deliveroo to undertake a noise assessment for new plant at a proposed Deliveroo kitchen at Unit 57, Milford Road industrial estate.
- 7.2. The noise impact from the proposed plant has been predicted at the nearest noise sensitive receptors to the site and assessed following the guidance provided in the Noise Policy Statement for England, the National Planning Policy Framework (NPPF), BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' and BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'.
- 7.3. The predictions demonstrate that cumulative noise from the proposed plant should be acceptable to the local authority at all nearby receptors and all times, inclusive of suitable atmospheric-side attenuators fitted to the fresh air supply and kitchen extract systems.
- 7.4. Therefore, noise from the proposals should not be a reason for refusal of planning permission.

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.
$L_{Aeq,T}$	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 that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example.

Appendix B Aerial Photograph of site showing areas of interest



Appendix C Environmental Sound Survey

Details of environmental sound survey

- C.1 Measurements of the existing background sound levels were undertaken from 16:45 hours on Monday 13th November to 06:15 hours on Tuesday 14th November 2017.
- C.2 The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the survey.

Measurement position

- C.3 The sound level meter was positioned within the Deliveroo yard as shown in [¡Error! No se encuentra el origen de la referencia..](#) The microphone was positioned at a height of approximately 3.5m above ground level.
- C.4 The adopted position is considered to be representative of the noise climate affecting the nearest noise sensitive premises to the site.

Equipment

- C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 949 / 8195	24/10/2016	1610560
Condenser microphone	MCE212/ 22267		
Preamplifier	Svantek SV12L / 7557		
Calibrator	Svantek SV 40A / 10843	06/10/2016	1610518

Weather Conditions

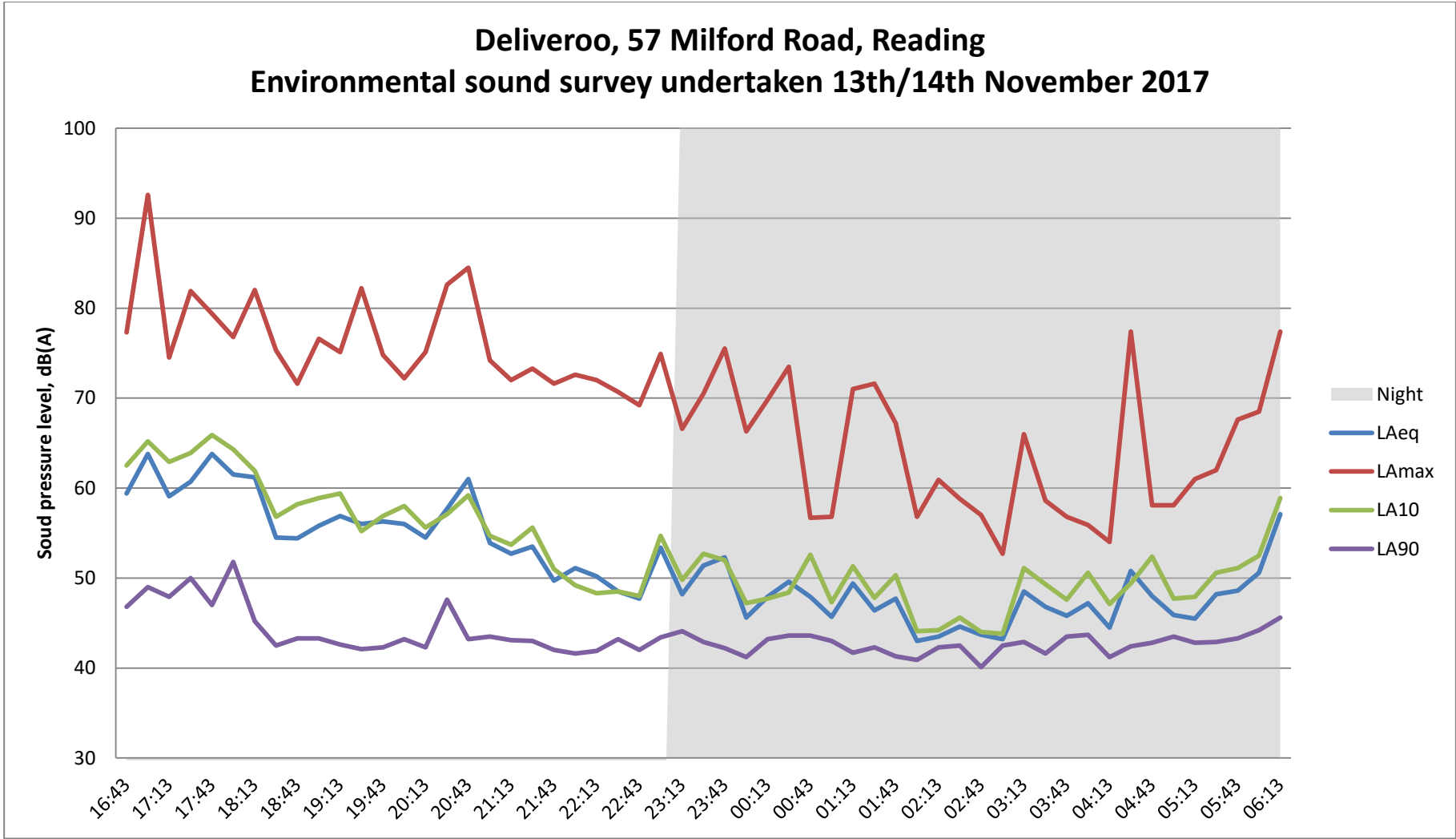
- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	15:30 03/11/2017- 10:15 06/11/2017	Temperature (°C)	8	6
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:	No	No
		Cloud cover (oktas - see guide)	2	4
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	<1	<1
		Wind Direction	---	---
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.7 The results of the survey are considered to be representative of background sound pressure levels at the façades of the nearest noise sensitive receptors to the proposed plant area. The noise climate during the survey period was dominated by road traffic movements and noise from other industrial premises. The results of the survey are presented in a time history graph overleaf.

Deliveroo, 57 Milford Road, Reading
Environmental sound survey undertaken 13th/14th November 2017



Appendix D Manufacturer plant noise data

Description	Model / Model	Quantity	Notes.	Sound level(dB) at octave band centre frequencies (Hz)								L _{Aeq,T} (dB)
				63	125	250	500	1k	2k	4k	8k	
Kitchen Extract	Fläkt Woods	6	In-duct L _w Outlet	---	114	101	91	85	81	76	72	100
AHU	Fläkt Woods	2	In-duct L _w Inlet	120	114	105	95	88	84	81	80	102
Toilet Extract	Systemair K100L	2	In-duct L _w Outlet	84	81	78	67	63	59	50	40	72
General Extract	Systemair K315L	1	In-duct L _w Outlet	88	83	80	72	70	69	62	58	77
Catering condensing unit ¹	Unknown	3	Sound pressure level, L _p at 1m									60

¹The model of the catering condensing units is unknown. It has been assumed that the noise emissions by the catering condensing units will be 60dB at 1m

Receptor R1.1. Window of residential premises located along Cardiff Road

[illegible]

Receptor R1.2. Garden of residential premises located along Cardiff Road

[illegible]

Appendix F Kitchen extract systems

Receptor R1.1. Window of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level each	In-duct L_w		114	101	91	85	81	76	72	100
Cumulative effect	6 fans		7	7	7	7	7	7	7	
System losses			-5	-1	-2	-3	-4	-4	-4	
Atmospheric side attenuator	I.L		-8	-16	-24	-31	-25	-18	-10	
Directivity correction (m)	(0,90)		-1	-5	-8	-7	-7	-7	-7	
Distance correction (m)	90		-47	-47	-47	-47	-47	-47	-47	
Barrier Loss			-5	-5	-5	-5	-5	-5	-5	
BS4142 feature correction			0	0	0	0	0	0	0	
Resultant at receptor	L_p		57	34	14	0	1	3	7	41

Receptor R1.2. Garden of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level each	In-duct Lw		114	101	91	85	81	76	72	100
Cumulative effect	6 fans		7	7	7	7	7	7	7	
System losses			-5	-1	-2	-3	-4	-4	-4	
Atmospheric side attenuator	I.L		-8	-16	-24	-31	-25	-18	-10	
Directivity correction (m)	(0,90)		-1	-5	-8	-7	-7	-7	-7	
Distance correction (m)	90		-44	-44	-44	-44	-44	-44	-44	
Barrier Loss			-5	-5	-5	-5	-5	-5	-5	
BS4142 feature correction			0	0	0	0	0	0	0	
Resultant at receptor	Lp		59	37	17	3	4	6	10	44

Appendix G Supply systems

Receptor R1.1. Window of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level each	In-duct Lw	120	114	105	95	88	83?	81	80	100
Cumulative effect	2 fans	3	3	3	3	3	3	3	3	
System losses		-8	-3	-1	0	0	0	0	0	
Atmospheric side attenuator	I.L	-4	-6	-11	-19	-25	-17	-11	-7	
Directivity correction (m)	(0,90)	0	-1	-5	-8	-7	-7	-7	-7	
Distance correction (m)	90	-47	-47	-47	-47	-47	-47	-47	-47	
Barrier Loss		-9	-9	-9	-9	-9	-9	-9	-9	
BS4142 feature correction		0	0	0	0	0	0	0	0	
Resultant at receptor	Lp	55	51	35	16	3	6	10	13	37

Receptor R1.2. Garden of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level each	In-duct Lw	120	114	105	95	88	83	81	80	100
Cumulative effect	2 fans	3	3	3	3	3	3	3	3	
System losses		-8	-3	-1	0	0	0	0	0	
Atmospheric side attenuator	I.L	-4	-6	-11	-19	-25	-17	-11	-7	
Directivity correction (m)	(0,90)	-0.25	-0.5	-4.5	-7.5	-7	-7	-7	-7	
Distance correction (m)	65	-44	-44	-44	-44	-44	-44	-44	-44	
Barrier Loss		-9	-9	-9	-9	-9	-9	-9	-9	
BS4142 feature correction		0	0	0	0	0	0	0	0	
Resultant at receptor	Lp	58	54	38	18	6	8	13	16	39

Appendix H Toilet extract systems

Receptor R1.1. Window of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level each	In-duct Lw	84	81	78	67	63	59	50	40	72
Cumulative effect	2 fans	3	3	3	3	3	3	3	3	
System losses		-19	-14	-10	-5	-3	-1	-1	-1	
Atmospheric side attenuator	I.L	0	0	0	0	0	0	0	0	
Directivity correction (m)	(0,90)	-0.25	-0.5	-4.5	-7.5	-7	-7	-7	-7	
Distance correction (m)	90	-47	-47	-47	-47	-47	-47	-47	-47	
Barrier Loss		-10	-10	-10	-10	-10	-10	-10	-10	
BS4142 feature correction		0	0	0	0	0	0	0	0	
Resultant at receptor	Lp	11	12	9	0	-1	-3	-12	-22	6

Receptor R1.2. Garden of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level each	In-duct Lw	84	81	78	67	63	59	50	40	72
Cumulative effect	2 fans	3	3	3	3	3	3	3	3	
System losses		-19	-14	-10	-5	-3	-1	-1	-1	
Atmospheric side attenuator	I.L	0	0	0	0	0	0	0	0	
Directivity correction (m)	(0,90)	0	-1	-5	-8	-7	-7	-7	-7	
Distance correction (m)	65	-44	-44	-44	-44	-44	-44	-44	-44	
Barrier Loss		-10	-10	-10	-10	-10	-10	-10	-10	
BS4142 feature correction		0	0	0	0	0	0	0	0	
Resultant at receptor	Lp	14	15	12	3	2	0	-9	-19	8

Appendix I General extract systems

Receptor R1.1. Window of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level	In-duct Lw	88	83	80	72	70	69	62	58	77
System losses		-12	-8	-4	-1	0	0	0	0	
Atmospheric side attenuator	I.L	0	0	0	0	0	0	0	0	
Directivity correction (m)	(0,90)	0	-1	-5	-8	-7	-7	-7	-7	
Distance correction (m)	90	-47	-47	-47	-47	-47	-47	-47	-47	
Barrier Loss		0	0	0	0	0	0	0	0	
BS4142 feature correction		0	0	0	0	0	0	0	0	
Resultant at receptor	Lp	29	27	24	16	15	14	7	4	22

Receptor R1.2. Garden of residential premises located along Cardiff Road

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level	In-duct Lw	88	83	80	72	70	69	62	58	77
System losses		-12	-8	-4	-1	0	0	0	0	
Atmospheric side attenuator	I.L	0	0	0	0	0	0	0	0	
Directivity correction (m)	(0,90)	0	-1	-5	-8	-7	-7	-7	-7	
Distance correction (m)	65	-44	-44	-44	-44	-44	-44	-44	-44	
Barrier Loss		0	0	0	0	0	0	0	0	
BS4142 feature correction		0	0	0	0	0	0	0	0	
Resultant at receptor	Lp	31	30	27	19	18	17	10	6	25

Receptor R1.1. Window of residential premises located along Cardiff Road

Plant item	Period	Source noise level		Distance correction		Directivity (dB)	Attenuation due to acoustic treatment ¹ (dB)	Cumulative existing noise levels at receptor L _{Aeq} (dB)
		Noise level, L _{Aeq} (dB)	Reference distance (m)	Distance to receptor (m)	Correction (dB)			
Catering condensing unit	Daytime	65	1	90	-39	3	-5	24
	Night-time	65	1	90	-39	3	-5	24
Cumulative daytime:								24
Cumulative night-time:								24

Receptor R1.2. Garden of residential premises located along Cardiff Road

Plant item	Period	Source noise level		Distance correction		Directivity (dB)	Attenuation due to acoustic treatment ¹ (dB)	Cumulative existing noise levels at receptor L _{Aeq} (dB)
		Noise level, L _{Aeq} (dB)	Reference distance (m)	Distance to receptor (m)	Correction (dB)			
Catering condensing unit	Daytime	65	1	65	-36	3	-5	27
	Night-time	65	1	65	-36	3	-5	27
Cumulative daytime:								27
Cumulative night-time:								27

Appendix K

