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Consultants in Acoustics, Noise & Vibration

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Iceland Manufacturing

Plant noise egress assessment

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Summary

Sandy Brown has been commissioned by Iceland Manufacturing to provide acoustic advice in relation to the recently installed cooling tower to the north of the site. An environmental noise survey has been carried out to determine the existing background sound levels in the area and assess the new plant against appropriate plant noise limits in line with the requirements of Manchester City Council.

The noise survey was performed between 09:45 on 22 November 2018 and 14:45 on 26 November 2018

The representative background sound levels measured during the survey were $L_{A90,15min}$ 56 dB during the daytime. The plant is not understood to be running during the night.

Based on the requirements of Manchester City Council and on the results of the noise survey, all plant must be designed such that the cumulative noise rating level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15min}$ 51 dB during the daytime. This limit applies with all plant operating under normal conditions.

The rating level of the cooling tower at the noise sensitive receiver is $L_{Aeq,16hrs}$ 73 dB, including tonality and intermittency corrections. This is 22 dB above the Manchester City Council criterion. This represents a significant adverse impact.

Details of potential mitigation measures to meet the required noise rating level have been provided.

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1 Introduction

Sandy Brown has been commissioned by Iceland Manufacturing to provide acoustic advice in relation to the recently installed cooling tower to the north of the site.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises in order to set appropriate limits for noise egress from building services plant.

This report presents the survey method, results of the environmental noise survey, a discussion of acceptable limits for noise emission from building services plant and an assessment of the already installed cooling tower.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1, highlighted in blue. The Iceland Manufacturing site is comprised of offices and a manufacturing area in the south, logistics to the north west, and workshop areas to the north east. The recently installed cooling tower is nearest these workshops, and is highlighted in a lighter blue. The cooling tower is only operational during the daytime (07:00-23:00).

The site is surrounded by industry and logistics premises. To the north is a mainline railway (between stations at Ashbury and Gorton). The nearest major road is Gorton Lane to the south.

2.2 Adjacent premises

The site is bounded to the north by industrial units including several garages. The nearest, Advanced Vehicle Technicians on Railway Street, is 30 m from the installed cooling tower. This is highlighted in Figure 1 in red. Other industrial units are highlighted in orange.

To the east, around 180 m away and screened from the site by other industrial units, are the nearest residential premises on Thorpeness Square and Gorting Avenue. These are highlighted in yellow.



Figure 1 Site plan, courtesy of Google Earth Pro# Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 5 days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 15 minute periods between 09:45 on 22 November 2018 and 14:45 on 26 November 2018. The equipment was installed and collected by Daniel Shaw.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. Photographs showing the measurement location are provided Figure 2 and Figure 3. This location was chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises. The microphone was placed 1.5 m from the ground and more than 3 m from other reflective surfaces.



Figure 2 Photograph of logger location facing south towards the cooling tower



Figure 3 Photograph of logger location facing north towards the nearest sensitive receiver

3.2 Attended measurements

Attended sample measurements were performed by Daniel Shaw at a number of locations around the site and at the nearby residential premises. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out on 22 November 2018, over 15 minute periods, with the purpose of determining the existing noise levels from road traffic, industrial activity, and other significant noise sources in the area, and also the noise levels affected by the cooling tower. The measurement 1 m from the cooling tower was to determine the source strength

The locations of the measurements are indicated in Figure 4 to Figure 7. In each case the microphone was mounted on a tripod approximately 1.5 m above the ground level. For measurements at noise sensitive receivers the microphone was exactly 1 m from the facade. The measurement conducted 10 m from the cooling tower was conducted at least 3 m from any other reflective surface.



Figure 4 Photograph of measurement position 1



Figure 5 Photograph of measurement position 2



Figure 6 Photograph of measurement position 3



Figure 7 Photograph of measurement position 4

4 Measurement results

4.1 Observations

4.1.1 At garage and around site

When the cooling tower was not running, the dominant noise sources observed at the site during the survey consisted of lorries idling and forklift trucks moving pallets around, generally from the logistics area to the west of the plant, but also from other industrial units. There was also less distinct activity noise from other units. Trains were audible at this time.

When the cooling tower was running, this dominated the noise climate. Trains were observed but not audible during this time.

4.1.2 At nearby residential

The noise climate at the residential premises was dominated by distant traffic and some nearby industrial activity noise. Less significant noise sources included infrequent train pass-bys, water hose noise, reversing tones and children in a distant playground.

The cooling tower was inaudible at this location.

4.2 Unattended measurement results

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 1.

All unattended measurements are conducted in the free field.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00-23:00) $L_{Aeq,16h}$ (dB)	Night (23:00-07:00) $L_{Aeq,8h}$ (dB)
Thursday 22 November 2018	-	60
Friday 23 November 2018	72	60
Saturday 24 November 2018	58	57
Sunday 25 November 2018	58	58
Monday 26 November 2018	-	-
Average	63	59

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, daytime typical levels have been quantified using statistical analysis from the continuous logging measurements.

Daytime statistical analysis of representative values for the site are given in Figure 8.

The installed cooling tower is not operational during the night-time so this period has not been assessed.

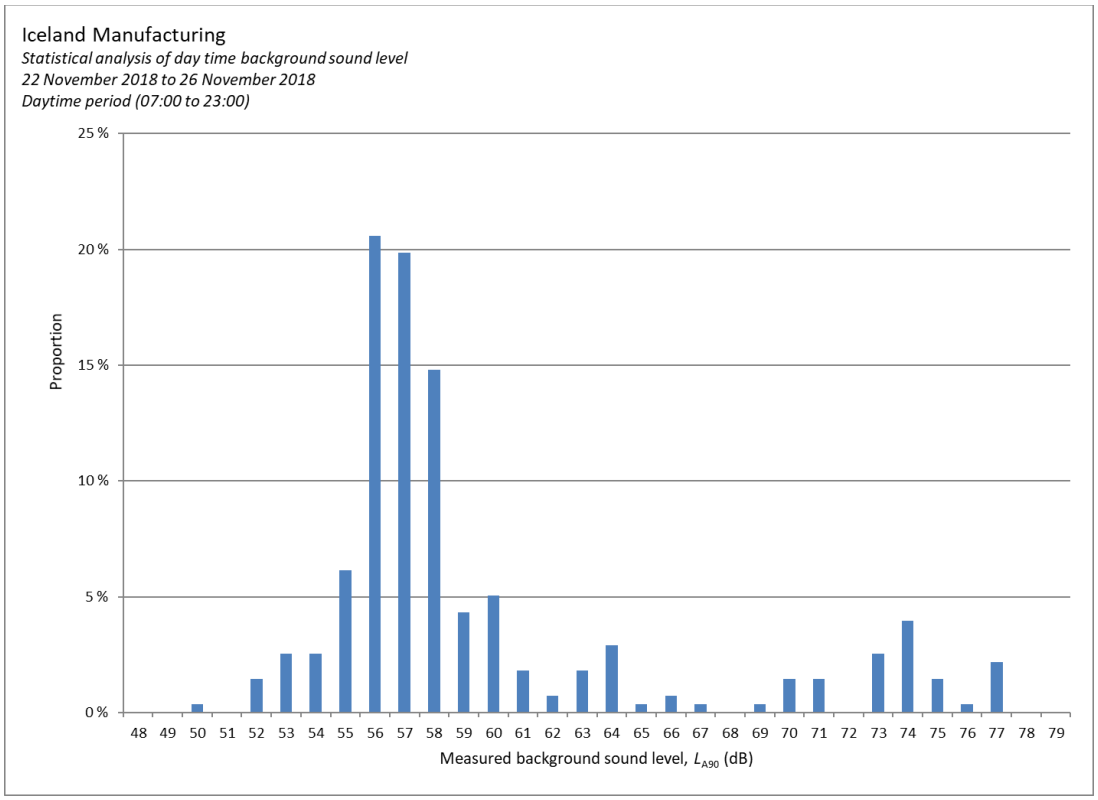


Figure 8 Measured background sound levels, L_{A90} (dB), during the daytime

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 56 dB during the daytime.

4.3 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 2. The dominant noise sources noted during the measurements are also described in Table 2. All the attended measurements were performed over 15 minute periods.

Positions 2, 3 and 4 were facade measurements – conducted 1 m from the nearest reflective surface. Position 1 was conducted in the free field – 3 m from reflective surfaces other than the ground.

Table 2 Sound pressure levels from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
1	10:24	69	83	62	Cooling tower, idling lorries
2	10:49	87	92	81	Source measurement of cooling tower, 1m from fan
3	11:15	68	80	65	During cooling tower operation
3	11:30	68	80	66	During cooling tower operation
3	11:47	58	75	54	Ambient measurement, idling vehicles and industrial activity noise
3	12:03	60	76	56	Ambient measurement, idling vehicles and industrial activity noise
4	12:30	46	58	43	Ambient measurement – distant traffic and industrial activity
4	12:46	45	55	44	Ambient measurement as above, plant operational during final few minutes, inaudible
3	13:15	71	74	70	During cooling tower operation
3	13:31	66	77	57	During operation until 13:35 – additional scraping noise then powered down for the rest of the measurement

The average of measurements at position 3 from 11:15 to 11:45 were used as the ambient sound level, and the average of measurements from 11:47 to 12:18 were used as the residual sound level for the assessment per BS4142:2014.

5 Building services noise egress limits

5.1 Standard guidance

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a correction, based on the type and impact of those features, is applied.

5.2 Local Authority criteria

Manchester City Council specify that noise from new items of plant should be assessed in line with BS4142:2014, and that the rating level calculated 1 m from the facade of the nearest noise sensitive receiver should be 5 dB beneath the existing background sound level.

5.3 Limits

5.3.1 Basic limits

It is understood the plant will not operate during the night. As such, limits do not need to be set at the residential premises during the night.

Based on the above criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 3.

Table 3 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Daytime (07:00-23:00)	51

The limits set out in Table 3 do not include any attention catching features. The corrections for attention catching features may be significant. This is discussed further in Section 5.3.2.

5.3.2 Attention catching features

As the installed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit below those set out above, based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

5.4 Assessment

5.4.1 Noise rating level calculation

All calculations have been performed in octave bands.

The ambient sound level has been based on measurements at position 3 between 11:15 and 11:45 while the cooling tower was operating. The ambient sound level is L_{Aeq} 68 dB.

The residual sound level was measured at position 3 between 11:47 and 12:18, while the cooling tower was not operating at all. The residual sound level is L_{Aeq} 59 dB.

The specific sound level has been calculated to remove the contribution of the residual level from the ambient. This allows the assessment of the cooling tower alone. The specific sound level is L_{Aeq} 67 dB.

It is understood the cooling tower would run for a maximum operating time of 12 hours consisting of up to 16 cycles a day at 45 minutes during each cycle. Correcting for the maximum operating times the rating level at the nearest receiver is $L_{Aeq,16hrs}$ 66 dB.

During a cycle, water noise is constant while fan noise turns on and off roughly every 2 minutes. For this reason, a 3 dB intermittency correction is applied.

The sound of the fan spinning up is clearly tonal and increases in frequency, while at steady state the fan noise is atonal. For this reason, a 4 dB tonality correction is applied.

Including the corrections for attention catching features, the rating level 1 m from the nearest noise sensitive receiver is $L_{Aeq,16hrs}$ 73 dB. This is 22 dB over the MCC plant noise egress limit of $L_{Aeq,15min}$ 51 dB.

5.4.2 Mitigation measures

The combination of any mitigation measures needs to reduce the noise level of the cooling tower by 22 dB. It is recommended that an acoustic enclosure be applied to the tower.

Typical required octave band insertion losses are below. These may be higher or lower in each octave band but the overall reduction should be at least R_w 22 dB. Proposed enclosures can be checked by Sandy Brown to confirm suitability.

Table 4 Minimum octave band insertion losses

	Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Insertion loss (dB)	3	4	11	20	27	28	30	30

The viability of such an enclosure would need to be checked with the building service engineer in conjunction with the enclosure supplier.

Based on this option being adopted no further attenuation measures would be needed. Example suppliers of acoustic enclosures are set out below:

- Environ www.environ.co.uk
- IAC Acoustics www.iac-noisecontrol.com
- Noico Ltd www.noico.co.uk
- Wakefield Acoustics www.wakefieldacoustics.co.uk

6 Conclusion

A noise survey has been carried out to determine the existing background sound levels in the vicinity of the site and surrounding noise sensitive premises. The representative background sound levels were $L_{A90,15min}$ 56 dB during the day. It is understood that the cooling tower will not be operational during the night-time (23:00-07:00).

On the basis of the requirements of Manchester City Council, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 51 dB during the day.

These limits are cumulative, and apply with all plant operating under normal conditions.

An assessment of the recently installed cooling tower has been carried out. The current rating level at 1 m from the nearest noise sensitive receiver is $L_{Aeq,16hrs}$ 73 dB. This includes 7 dB of corrections for tonality and intermittency. This exceeds the Manchester City Council limit by 22 dB.

Mitigation measures have been proposed. As long as these are incorporated within the design, the cooling tower is expected to comply with the relevant noise limits.

Appendix A

Survey details

Equipment

A Rion NL52 sound level meter was used to undertake the unattended measurements. The attended measurements were carried out using a Bruel & Kjaer 2250 sound level meter. The calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	2250/3011964	Bruel & Kjaer	4 Sep 19	UCRT17/1750
Preamplifier	ZC0032/26376	Bruel & Kjaer	4 Sep 19	UCRT17/1750
Microphone	4189/3100176	Bruel & Kjaer	4 Sep 19	UCRT17/1750
Calibrator	4231/3019123	Bruel & Kjaer	4 Sep 19	UCRT17/1748
Sound level meter	NL52/00932326	Rion	15 Mar 19	TCRT17/1087
Preamplifier	NH25/32354	Rion	15 Mar 19	TCRT17/1087
Microphone	UC59/05549	Rion	15 Mar 19	TCRT17/1087
Calibrator	NC74/34125432	Rion	15 Mar 19	TCRT17/1085

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meters used in this survey are available upon request.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

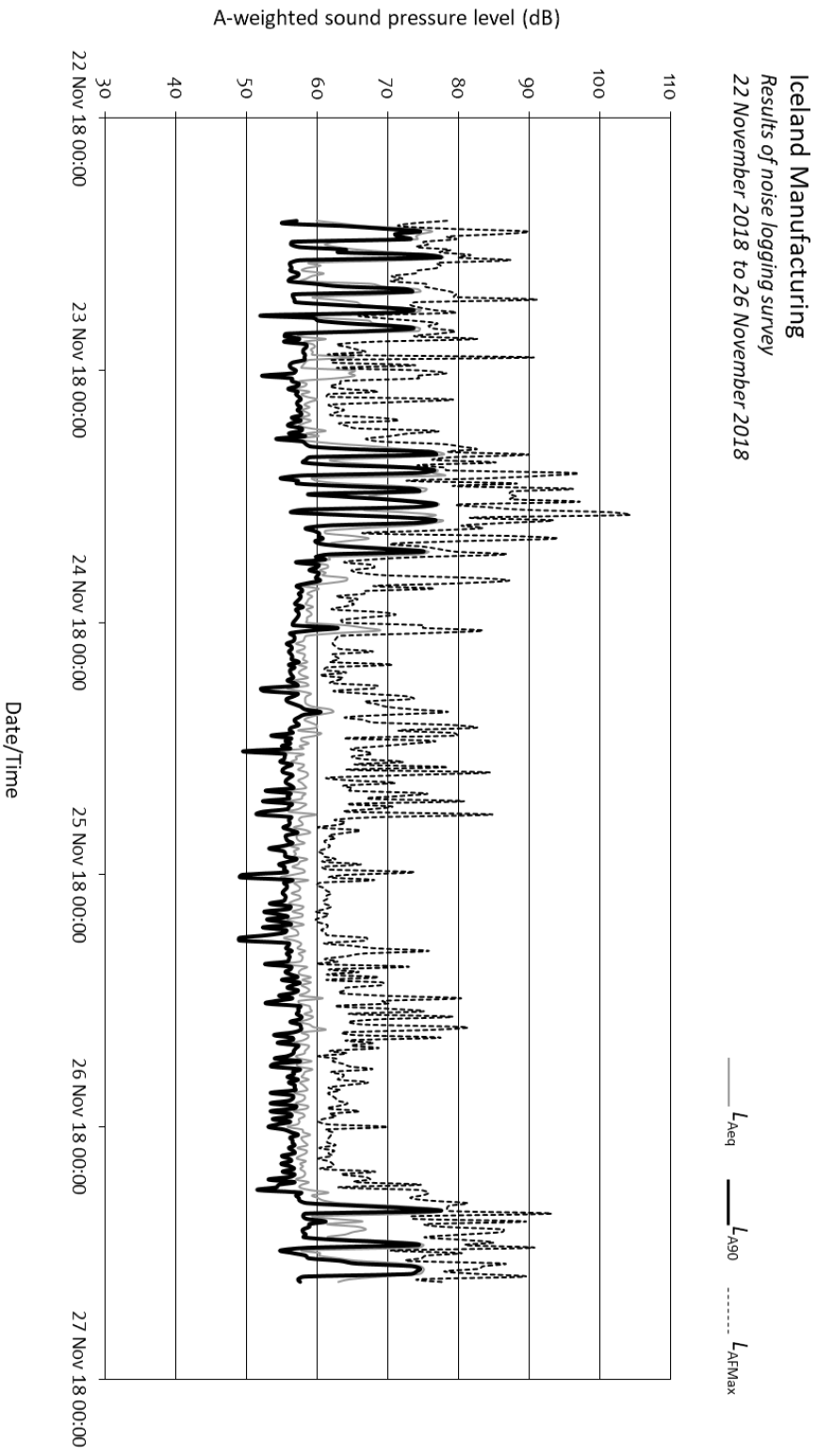
During the attended measurements carried out on 22 November 2018, the weather was overcast but dry and no rain occurred until after measurements had finished. Wind speeds varied between approximately 0 m/s and 2 m/s.

During the unattended noise measurements between 22 November 2018 and 26 November 2018, weather reports for the area indicated that temperatures varied between 0°C at night and 6°C during the day, and the wind speed was less than 7 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location L


Iceland Manufacturing
Results of noise logging survey
22 November 2018 to 26 November 2018
A-weighted sound pressure level (dB)
30
40
50
60
70
80
90
100
110
22 Nov 18 00:00
23 Nov 18 00:00
24 Nov 18 00:00
25 Nov 18 00:00
26 Nov 18 00:00
27 Nov 18 00:00
Date/Time
LAeq
LA90
LAFMax