

3.0

Environmental noise survey

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3.1 Site description

The site is located at Great Ducie Street, Cheetham Hill, Manchester, M3 1PT in central Manchester. The former Boddingtons brewery site is currently operated as an open-air car park with Great Ducie Street (A56) bounding the site to the west. Beyond the A56 are warehousing units with the River Irwell behind them.

At the north boundary of the site is the Travelodge Manchester Central Arena hotel, at the corner of Great Ducie Street and Francis Street, with warehousing units and HMP Strangeways beyond to the north. East of the site are a couple of vacant lots, with mixed retail and open-air car parking areas beyond.

At the south boundary of the site is an ongoing development of a new five-storey educational development for The Manchester College beyond which is the internal Ring Road and the AO Manchester Arena.

3.2 August 2021 survey – road traffic impacts

3.2.1 Survey locations

To assess the levels of environmental noise affecting the site, a number of attended noise measurements undertaken at various parts of the daytime and night-time period have been carried out, generally in accordance with BS 7445. During the attended noise survey at the site, the dominant noise source throughout the daytime period was the A56 running adjacent to the site, with some contribution from other distant roads. As the site was unsecured, it was not possible to leave unattended long-term monitoring equipment at the site.

Measurement periods were selected to try and capture the quietest part of the day (12:30 to 16:15), quietest part of the night (00:00 to 04:00) and the loudest parts of the night and day corresponding to morning rush hour (05:00 to 09:00). All measurements were undertaken on typical weekdays.

No contributions from other sources were noted.

With a view to establishing the existing noise climate across the site, attended noise surveys were undertaken at the following locations, highlighted in Figure 3-1, overleaf.

MP1 – Selected as being representative of typical noise climate at worst-case affected dwellings situated closest to Great Ducie Street

MP2 – Selected as being representative of background noise climate at closest façade of adjacent Travelodge Manchester Central Arena hotel

MP3 – Selected as being representative of the quieter noise climate towards the rear of the site

The approximate site boundary is shown in **RED**, with the adjacent Travelodge hotel highlighted in **CYAN**. 30-minute measurements were undertaken at each of the three highlighted measurement positions, with the microphone at a height of approximately 3.5 m above local ground level, in a free field location.

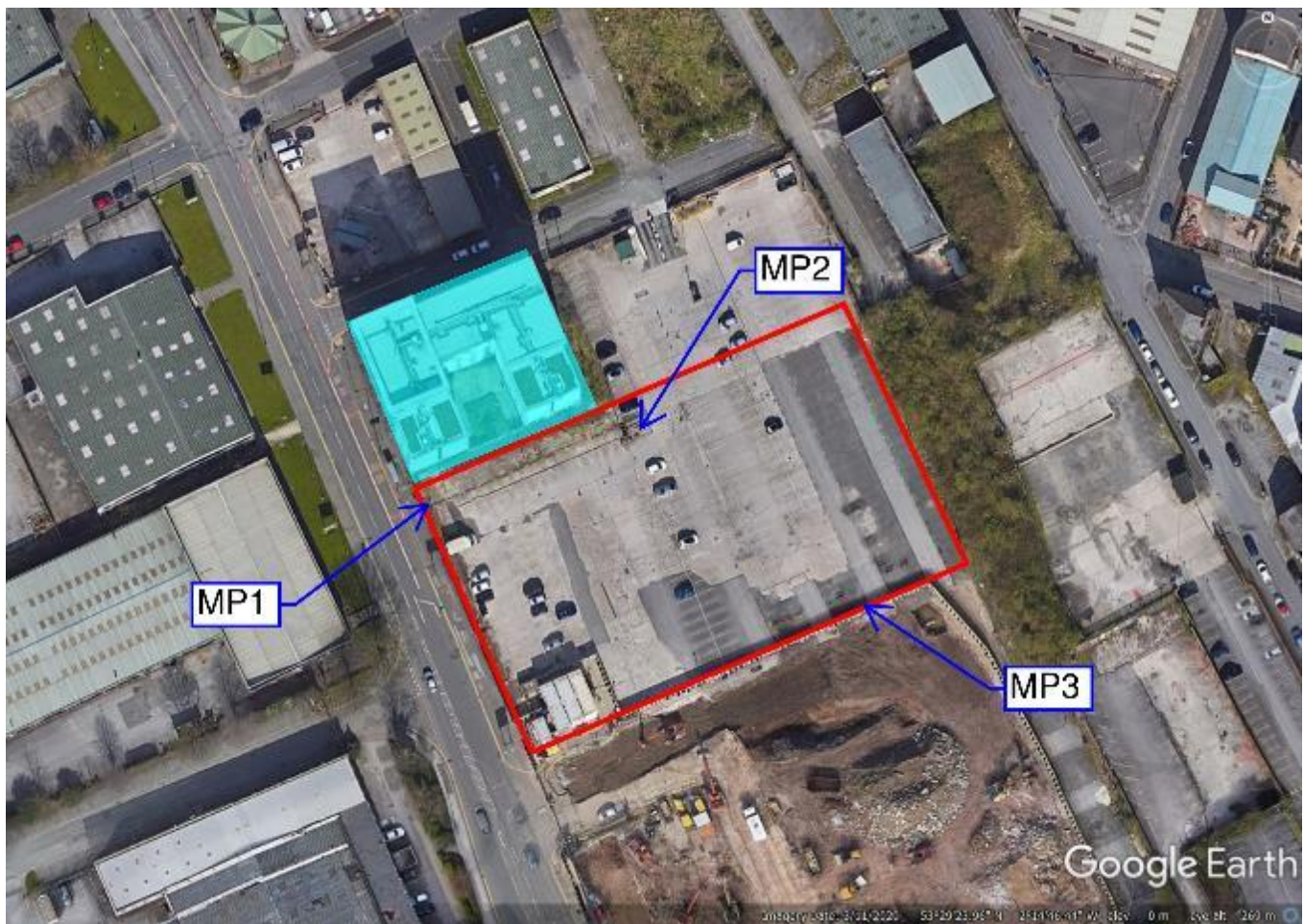


Figure 3-1: Site overview showing measurement positions (August 2021)

3.2.2 Equipment used

The instrumentation used during the surveys conforms to BS EN 60651 Type 1 accuracy. External laboratory certificates can be provided upon request. For attended survey works, the sound level meter was extended with a cable and the microphone fitted inside a weatherproof windshield, which was then mounted on a pole.

The sound level meter was calibrated before and after each survey in accordance with the manufacturer's instructions. No significant drift was noted to have occurred.

An NTi XL2-TA Class 1 sound level meter was used for all measurements.

3.2.3 Weather conditions

During the early morning and daytime measurements, the weather was warm, dry and still, while at night the temperature was mild. All windspeeds were $<5\text{ms}^{-1}$.

3.2.4 Survey results

The following table summarises the results gathered across the four days of measurements undertaken. The values shown include the following notations:

- Average noise levels: for short term monitoring, the $L_{Aeq,T}$ values are shown with the time, T , being equivalent to the monitoring duration (30 minutes);
- Maximum noise levels: for short term monitoring periods, the highest measured maximum instantaneous noise level, L_{AFmax} , is declared;
- Background noise levels: for short term monitoring, the L_{A90} is declared, with the time period equivalent to the measurement period (30 minutes).

All values in Table 3-1 below are A-weighted decibels, dB(A).

Position	Date	L _{Aeq,30min} dB	L _{AFmax} dB	L _{A90,30min} dB
MP1	23/08/2021 12:34-13:04	71	88	62
	23/08/2021 14:31-15:01	71	83	61
	24/08/2021 00:16 - 00:46	67	79	48
	24/08/2021 02:05 - 02:35	65	79	45
	26/08/2021 07:08 - 07:38	72	92	62
	26/08/2021 05:10 - 05:40	65	81	45
MP2	23/08/2021 13:20 - 13:50	62	83	54
	23/08/2021 15:07 - 15:37	58	74	54
	24/08/2021 00:52 - 01:22	54	71	43
	24/08/2021 02:41 - 03:11	50	65	40
	26/08/2021 07:42 - 08:12	60	85	56
	26/08/2021 05:48 - 06:18	55	68	46
MP3	23/08/2021 13:56 - 14:26	57	80	51
	23/08/2021 15:45 - 16:15	56	79	51
	24/08/2021 01:27 - 01:57	47	61	39
	24/08/2021 03:26 - 03:56	45	61	36
	26/08/2021 08:18 - 08:48	62	88	53
	26/08/2021 06:27 - 06:57	53	72	48

Table 3-1: Summary of noise survey results (August 2021)

3.3 January 2022 survey – AO Arena Impacts

3.3.1 Survey locations

At the time of the August 2021 Cundall survey, it was not possible to undertake a survey during a music performance at the AO Arena due COVID-19 related event postponements.

Separate attended measurements of noise impacts during an AO Arena event were subsequently undertaken on 24 January 2022 during the 'Big Night of Musicals' event at the Arena. The event comprised a number of music performances including songs from rock music based musicals such as Bat Out of Hell and School of Rock. Timings of the event taken from the AO arena website were confirmed as being "between 7.30pm and 9.00 pm".

Measurement periods were selected to capture the noise climate immediately before the event (starting from approximately 18:15) in the absence of entertainment noise, and then continuing for the full duration of the event until the 21:00 curfew.

With a view to establishing the ambient noise climate across the site during an event, attended noise surveys were undertaken at two separate locations as highlighted in Figure 3-2 and in the photographs presented in Figure 3-3.

MP4A – Selected as being representative of typical noise climate at worst-case area of current car park (Note: Measurement position was outside of the Development red line boundary, in a position which allowed for direct line-of-sight to the AO Arena)

MP4B – Selected as being positioned closer to the AO area in a location more screened from the A56 Great Ducie Street due to the massing of the Manchester College scheme which is nearing completion.



Figure 3-2: Site overview showing measurement positions (January 2022 survey)

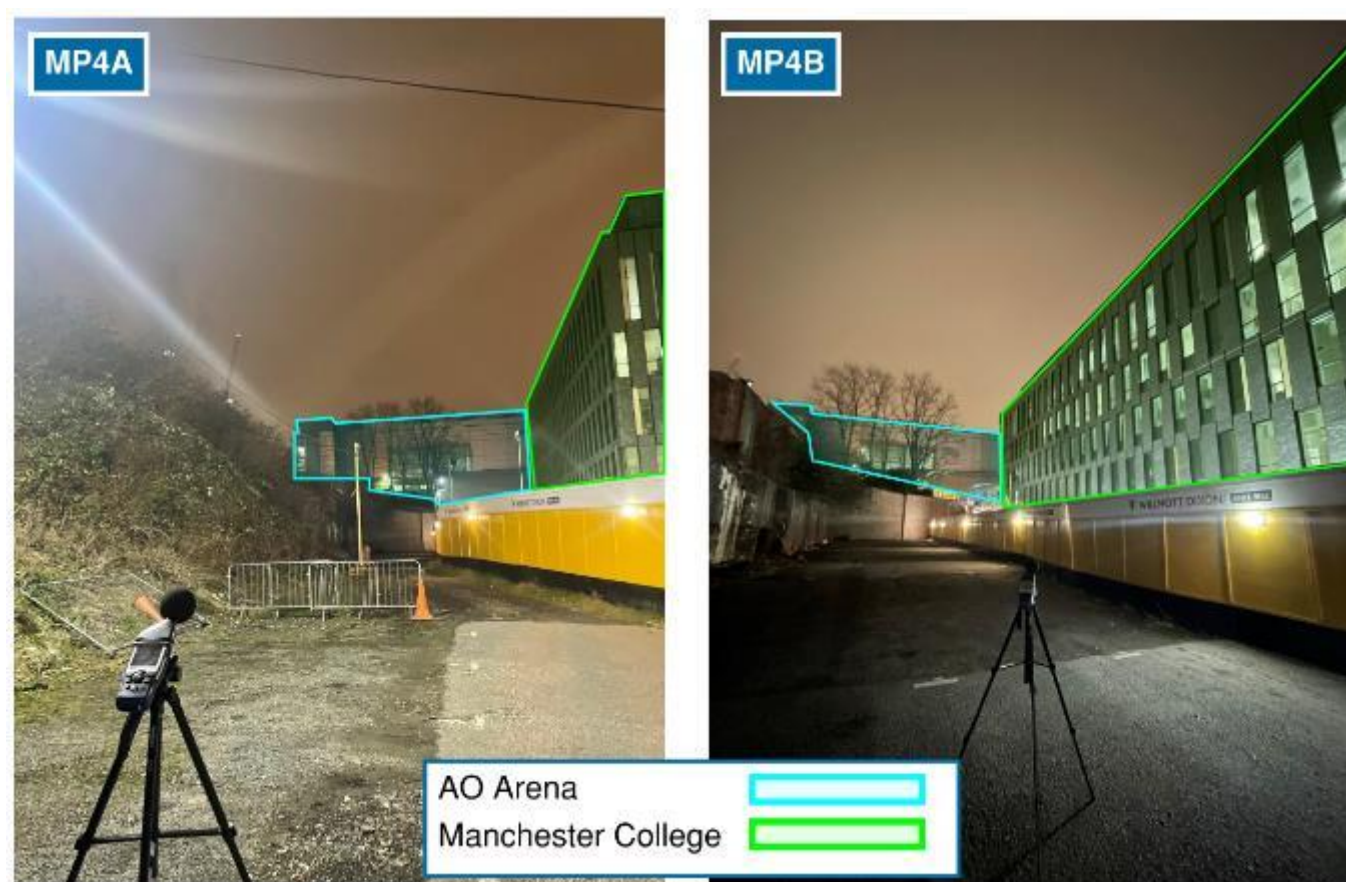


Figure 3-3: Measurement positions with views to AO Arena

Subjective impressions of the noise climate during the survey at both locations are summarised in the following table:

Position	Subjective impressions	
	Before music event	During music event
MP4A	Noise climate dominated by road traffic along A56 Great Ducie Street with some contribution from other surrounding roads.	Road traffic along Great Ducie Street remained the dominant noise source, although low-frequency music contributions were audible between lulls in local traffic. Peaks in $L_{AF,max}$ and low-frequency noise from the AO Arena were noted to be lower than from the highest contributions due to loud music from passing vehicles.
MP4B	Noise climate dominated by road traffic along A6042 Ring Road with some contribution from other surrounding roads.	Road traffic along A6042 Ring Road remained the dominant noise source, although low-frequency music contribution was just audible throughout most of the measurement.

Table 3-2: Subjective impressions during attended survey

3.3.2 Equipment weather conditions

The equipment used was identical to that reference in Section 3.2.2. The weather was cold, dry and calm with all windspeeds $<5\text{ms}^{-1}$.

3.3.3 Survey results

The following table summarises the results gathered across the four days of measurements undertaken. The values shown include the following notations:

- Average noise levels: the $L_{Aeq,T}$ values are shown with the time, T , being equivalent to the measurement duration;
- 1/1 individual octave band level: the low-frequency content in 63 Hz octave band is declared;
- Background noise levels: for short term monitoring, the L_{A90} is declared, with the time period equivalent to the measurement period (30 minutes)

All values in Table 3-1 below are A-weighted decibels, dB(A).

Locations	Start (hh:mm)	Duration (h:mm:ss)	$L_{Aeq,T}$ dB	$L_{Aeq,T}$ @ 63 Hz dB	L_{AFmax} dB
MP4A	18:10	0:14:55	49	37	66
MP4B	18:30	0:14:40	50	37	66
MP4A	18:47	1:12:05	49	34	68
MP4B	20:00	0:14:15	50	36	59
MP4A	20:18	0:41:44	50	35	67

Table 3-3; Summary of noise survey results (January 2021 survey)

Time trace plots for the instantaneous ($\Delta t = 0.01$ second) 63 Hz octave band results are presented in 0

3.3.4 Analysis of AO Arena impacts

As can be seen from the results presented in Table 4, there is minimal variation in the overall average $L_{Aeq,T}$ or the 63 Hz octave band content when comparing pre- and during-event values. This is in line with the subjective impression that whilst low-frequency AO Arena noise was occasionally audible, it was not a dominant contributor to the overall ambient noise climate.

In terms of the magnitude of low-frequency noise impacts, the measured levels of ≤ 37 dBA @ 63 Hz would be considered relatively modest for a city centre environment. For context, the measured 63 Hz octave band value at MP3 during the daytime (08:18 - 08:48) was 39 dBA.

Due to the physical properties of low-frequency sound pressure waves, partially open windows (and other small opening in general) provide much better sound insulation at lower frequencies in comparison to mid-frequencies. This is demonstrated in the following sound insulation research data presented by 'The Building Performance Centre, School Of The Built Environment, Napier University²¹' for a variety of windows tested with different opening configurations.

²¹Fuller, T., Lurcock, D., Mackenzie, R., & MacKenzie, R. (2006). Open/closed window research: sound insulation through ventilated domestic window

	Octave Band Centre Frequency (Hz)							$D_{n,w}$ (C;C _{tr})
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Opening A-1	20.6	15.7	15.5	20.2	18.7	22.0	23.0	21 (-1; -2)
Opening A-2	20.2	16.6	15.2	20.2	18.6	21.6	23.0	21 (-1; -2)
Opening A-3	21.3	15.1	18.5	19.0	15.9	20.7	23.6	20 (-1; -2)
Opening B	22.1	14.9	15.5	19.2	12.5	18.4	23.6	17 (-1; -2)
Opening C-1	24.0	18.4	22.5	17.9	16.4	21.8	25.1	19 (0; -1)
Opening C-2	24.4	18.3	20.6	20.1	15.8	23.0	26.9	21 (-2; -3)
Opening C-3	24.1	19.2	24.8	18.0	16.9	22.3	26.0	20 (-1; -1)
Opening C-4	24.4	19.0	22.9	20.1	15.9	23.2	27.1	21 (-1; -3)
Opening D-1	23.7	17.3	20.8	16.9	19.7	19.8	21.1	19 (0; 0)
Opening D-2	24.8	16.5	14.4	21.5	13.7	17.7	18.6	17 (-1; -1)
Opening D-3	25.0	16.8	15.6	21.0	18.0	20.2	22.1	20 (-1; -1)
Opening E	24.4	18.6	19.6	18.7	19.0	20.6	21.9	20 (0; -1)
Opening F	24.7	17.8	19.2	18.6	19.6	20.2	22.7	20 (0; -1)
Opening G	24.0	17.5	18.8	18.1	18.5	17.6	19.6	18 (0; 0)

Table 5-4 Derived $D_{n,w}$ result for "100,000 mm²" open windows (L6, S1, R2-6) (dB)

Figure 3-4: Research data showing increased sound insulation performance at 63 Hz in comparison to other octave bands

Based on the sound insulation values presented in Figure 3-4 and the measured 63 Hz values in Table 3-3, it can be seen that external noise intrusion associated with low-frequency noise from the AO Arena is likely to be negligible, even with partially open windows. Even if accounting for possible increase to the measured low-frequency content (e.g. due to potentially louder AO Arena events, apartments at upper floor levels which may have greater line-of-sight to AO Arena) it is expected that the external noise break-in will remain negligible, especially when considering masking internal noise generated by MVHR systems.