

Design Note

Project 200702 Technical Design Note - Noise and Vibration 02
Subject Acoustic response to Manchester City Council EHO comments
Project no 0042841
Date 2 July 2020

Revision	Description	Issued by	Date	Approved (signature)
00	Acoustic response to Manchester City Council EHO comments	JG	12/06/20	BFB
01	Comments from Deloitte included	JG	17/06/20	BFB
02	Reassessment of background noise levels in accordance with MCC planning guidance	JG	02/07/20	BFB

1 Introduction

The aim of this design note is to clarify the comments received from Manchester City Council (MCC) with regards to the Noise and Vibration chapter of the Project Bradford Environmental Statement (ES) submitted in March 2020, followed by an updated acoustic chapter in April 2020.

The following comments from MCC concern Acoustics:

"Acoustics

The acoustic report submitted with the application has been reviewed. The proposals for setting the limits for entertainment noise breakout and the 5dB allowance for an open window is acceptable. However, further details on what the predicted noise levels will be at the residential receptors identified (noise breakout, people noise, traffic noise etc.) needs to be provided as the report just says negligible.

Plant

The acoustic report submitted with the application has been reviewed. A modal background for the plant assessment has been used which is not in line with City Council guidance. As such, the report needs to be updated."

Clarifications on these points above were provided within the appendices of the original ES report. For clarity, these points have been reproduced in this design note and specific information has been added for completeness.

The criteria used for determining magnitude of change and significance of effect has been reproduced as well for reference in the following subsections.

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1.1 Identified receptors and their sensitivity

The identified closest high sensitivity receptors along with their noise and vibration sensitivities are identified in Figure 1—1 and presented in Table 1—1.

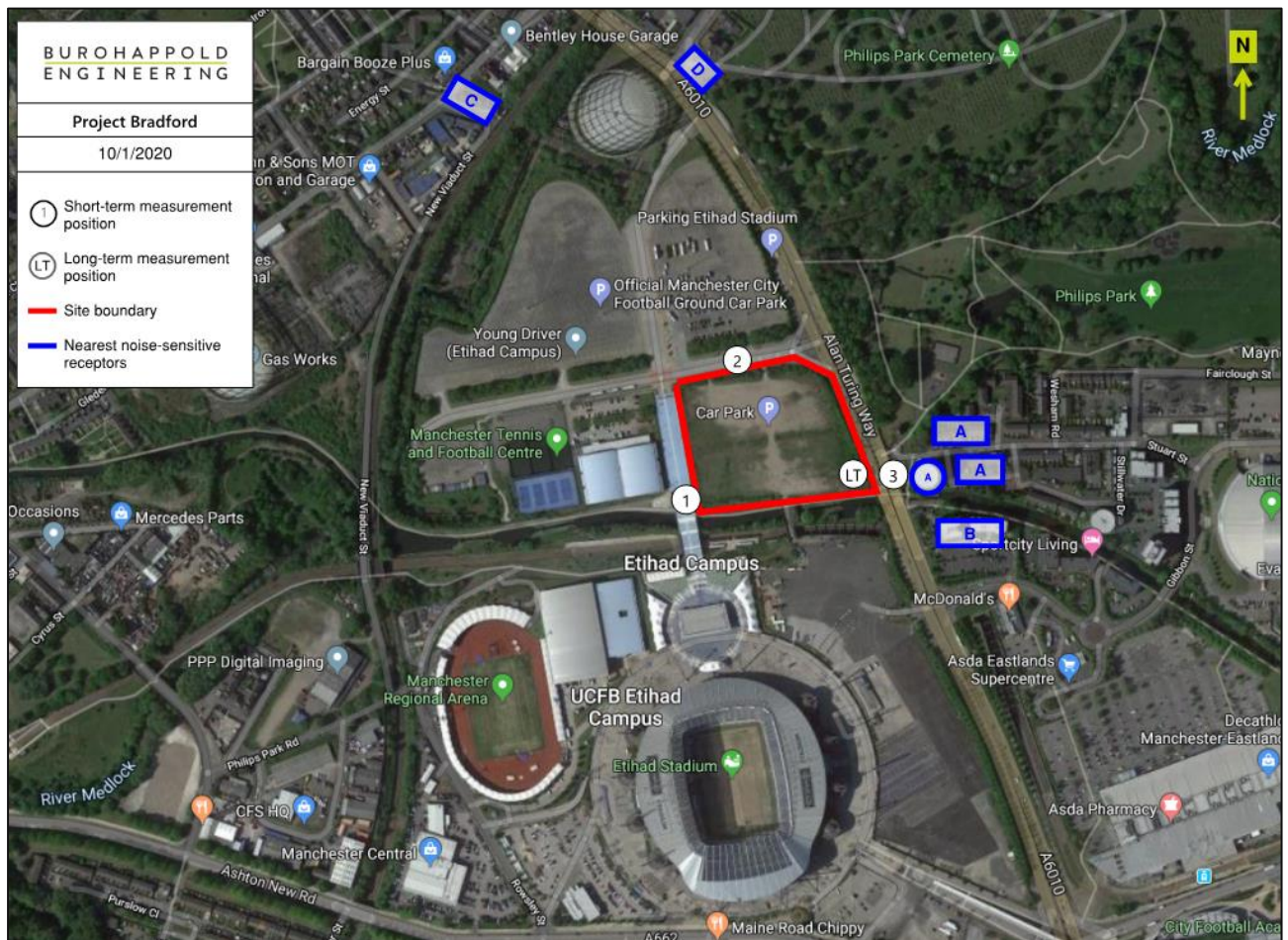


Figure 1—1 Noise monitoring positions and noise sensitive receivers

Table 1—1 Identified receptors and their sensitivity

NSR #	Receptor	Sensitivity	Justification
A	Stuart Street	High	Residential
B	Gibbon Street	High	Residential
C	Broxton Street	High	Residential
D	Briscoe Lane	High	Residential

For the assessment of the Proposed Development, high sensitivity receptors have been assessed to identify the worst-case impacts. Other moderate / low / negligible sensitivity receptors are the same distance or further away than the identified high sensitivity receptors. Therefore, as long as residential receptors are not adversely affected, then less sensitive receptors will also not be adversely affected.

Moderate / low / negligible sensitivity receptors have not been identified in Figure 1—1 and Table 1—1 for the reasons stated in the previous paragraph.

1.2 Magnitude of change / impact

The criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, are described in Table 1—2

Table 1—2 Criteria for determining magnitude of change / impact

Magnitude	Criteria
Large	Total loss or major / substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character / composition / attributes will be fundamentally changed.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character / composition / attributes of the baseline will be materially changed.
Small	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible / detectable but not material. The underlying character / composition / attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

Table 1—3 presents a summary of the quantitative criteria used to assess the magnitude of impact of each assessment.

Table 1—3 Summary of criteria for determining the magnitude of impact

Magnitude	Criteria	
	Construction	Operational
Large	• Construction noise: +10.0 dB > Assessment category • Construction traffic: 5.0 dB or more - $L_{A10,18\text{hours}}$ noise change • Construction vibration on humans: 10 mm·s⁻¹ PPV or more • Construction vibration on buildings: Greater than: – 60 mm/s at 4 Hz increasing to 80 mm/s at 15 Hz – 80 mm/s at 15 Hz increasing to 200 mm/s at 40 Hz and above	Operational traffic: 10.0 dB or more - $L_{A10,18\text{hours}}$ noise change Operational noise: +10.0 dB or more
Medium	• Construction noise: 5.0 to 10.0 dB > Assessment category • Construction traffic: 3.0 to 4.9 dB - $L_{A10,18\text{hours}}$ noise change • Construction vibration on humans: 1.0 mm·s⁻¹ PPV or more • Construction vibration on buildings: Greater than: – 30 mm/s at 4 Hz increasing to 40 mm/s at 15 Hz – 40 mm/s at 15 Hz increasing to 100 mm/s at 40 Hz and above	Operational traffic: 5.0 to 9.9 dB - $L_{A10,18\text{hours}}$ noise change Operational noise: 5.0 to 10.0 dB or more

Magnitude	Criteria	
	Construction	Operational
Small	• Construction noise: 3.0 to 5.0 dB > Assessment category • Construction traffic: 1.0 to 2.9 dB - $L_{A10,18\text{hours}}$ noise change • Construction vibration on humans: 0.3 to 1.0 mm·s⁻¹ PPV • Construction vibration on buildings: Greater than: – 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz – 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above	Operational traffic: 3.0 to 4.9 dB - $L_{A10,18\text{hours}}$ noise change Operational noise: 0.0 to 5.0 dB
Negligible	• Construction noise: 1.0 to 3.0 dB > Assessment category • Construction traffic: 0.1 to 0.9 dB - $L_{A10,18\text{hours}}$ noise change • Construction vibration on humans: 0.14 to 0.3 mm·s⁻¹ PPV • Construction vibration on buildings: Lower than: – 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz – 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above	Operational traffic: 0.1 to 2.9 dB - $L_{A10,18\text{hours}}$ noise change Operational noise: -10.0 (or less) to 0.0 dB
No change	• Construction noise: < Assessment category • Construction traffic: 0.0 dB - $L_{A10,18\text{hours}}$ noise change	Operational traffic: 0.0 dB - $L_{A10,18\text{hours}}$ noise change

1.3 Significance evaluation

The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 1—4.

Table 1—4 Matrix for determining effect significance

		Magnitude of change / impact			
		Large	Medium	Small	Negligible
Receptor sensitivity	High	Major	Major	Moderate/Minor	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate/Minor	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Note that moderate and major effects are considered to be 'significant' for the purposes of this assessment.

2 Operational noise from entertainment noise

The following criterion is from MCC, Planning and Noise, Technical Guidance document:

"A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open.

Entertainment noise (LAeq) should be controlled to 10 dB below the background noise level (LA90) without the entertainment noise present, in each octave band at the nearest noise sensitive location"

The MCC, Planning and Noise, Technical Guidance document also provides advice on structurally connected venues by comparing the entertainment noise levels against a noise curve (Moorhouse et al., 2005) in order to assess likelihood of low frequency noise complaints. These levels provide a good practical basis to assess low frequency noise. Furthermore, as stated in the MCC guidance:

"They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces.

Therefore a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be:

'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (Leq) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (Leq), respectively'.

This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue."

An attenuation of 5 dB, achieved by a façade containing an open window, has been applied at these low frequencies in order to derive an external noise level limit.

In addition, MCC guidance states that:

"Depending on the circumstances it could be that both the above criteria are applicable for the same development (new entertainment venue)".

It is noted, that LA90 noise levels at Measurement Position 3 and the Long-Term Measurement Position are similar. As such, LA90 spectral noise levels for use in the assessment to satisfy MCC criterion have been taken from the Long-Term Measurement Position and are considered representative of the nearest NSR.

For reference, LA90 spectral noise levels from the Long-Term Measurement position are presented in Table 2—1. It should be noted that, daytime noise levels as presented below are taken between 21:00 to 23:00 hours, on a non-event day, to reflect the expected worst-case baseline values during typical operating hours.

Table 2—1 Measured LA90 spectral noise levels at the Long-Term Measurement Position

Location	Time Period	Target Incident $L_{eq,T}$ Noise Level Limits (dB) at Octave Band Centre Frequencies (Hz)								dBA
		63	125	250	500	1K	2k	4k	8k	
NSR A - Properties along Stuart Street	Daytime (07:00-23:00 hours)	57	52	52	51	52	42	29	21	54
	Night-time (23:00-07:00 hours)	51	46	44	42	42	32	26	20	45

Operational noise in the form of entertainment noise is considered a long-term effect in this case.

In-line with the above, the following noise level limits for noise break-out from the Proposed Development is proposed at 1m from the nearest NSR window. These are based on both sets of noise entertainment criteria i.e. 10 dB below background noise levels and low frequency internal noise limits.

Table 2—2 Incident spectral noise level limits for the proposed arena at 1m from the nearest NSR (#1)

Location	Time Period	Target Incident $L_{eq,T}$ Noise Level Limits (dB) at Octave Band Centre Frequencies (Hz)								dBA
		63	125	250	500	1K	2k	4k	8k	
NSR A - Properties along Stuart Street	Daytime (07:00-23:00 hours)	52*	46*	42	41	42	32	19	11	44
	Night-time (23:00-07:00 hours)	52*	46*	34	32	32	22	16	10	35
*Based on the Moorhouse et al. internal noise limit for assessment of low frequency noise with 5 dB addition to account for the attenuation of a façade containing an open window.										

Should an assessment of noise break-out levels be subject to façade reflections (e.g. the windows are closed on the NSR) then the noise level limits detailed above are subject to a 3 dB addition in all octave band frequencies.

It is noted that NSR A is the most exposed NSR and compliance with the above should protect other NSRs by default.

The following internal noise level limits are proposed within the 'bowl' of the Proposed Development. It is understood that the 'bowl' will enclose the main stage and performance arena, and that the structure forming the concourse areas surrounding it will significantly mitigate noise transmission into the concourse / external areas.

Table 2—3 Internal noise levels within the 'bowl'

Description	Noise levels at Octave Band Centre Frequencies (Hz)							dBA
	63	125	250	500	1K	2k	4k	
Internal concert noise level $L_{Aeq,5min}$ dB	116	110	104	101	100	92	88	104

Vanguardia acoustics have stated the following:

"An assumption has been made on the expected crowd noise in the foyer and concourse areas based on measured sound levels at other venues. This dominates the sound levels in these areas more than the impact of the sound from the arena bowl."

It has therefore been assumed by Vanguardia acoustics that in the foyer and concourse areas the noise levels will not exceed L_{Aeq} 80-85 dBA from combined transmission from the arena 'bowl', background music and crowd noise.

Vanguardia acoustics have specified the combined sound insulation performance for the envelope of the Proposed Development (as shown in Table 2—4), which is expected to be suitable in order to control noise break-out such that it meets the target incident noise levels at the nearest NSR as detailed above. It is worth noting that Vanguardia acoustics have provided spectral values for the 'bowl', and a single-figure sound insulation performance (R_w) for the outer façades.

Table 2—4 Noise Break-Out Envelope Sound Insulation Requirements

Description	Sound insulation at Octave Band Centre Frequencies (Hz)							R _w
	63	125	250	500	1K	2k	4k	
Sound insulation for 'bowl' envelope	40	38	36	42	47	38	39	-
Façade areas outside the 'bowl' e.g. foyer, concourse areas	-	-	-	-	-	-	-	40

Table 2—5 presents the calculated noise level inside the closest NSR due to entertainment noise breaking out from the foyer and concourse areas of the Proposed Development.

Table 2—5 Calculated resulting noise levels at the closest NSR due to entertainment noise

Noise levels in the foyer and concourse areas of the Proposed Development *	Sound insulation of the envelope of the Proposed Development	External noise levels at the facade of the Proposed Development	Distance attenuation (70 metres)	Attenuation provided by a façade containing an open window	Resulting noise levels at NSR
< L _{Aeq} 80-85 dBA	R _w 40 dB	< L _{Aeq} 40-45 dBA	20log(70) =37 dB	5 dB	< 35 dBA
*From combined transmission from the arena 'bowl', background music and crowd noise					

In-line with the details above, the significance of effect from operational entertainment noise at each identified NSR is summarised in Table 2—6. It should be noted that these significances are based on assumed Vanguardia noise levels within the arena and proposed sound insulation requirements of the arena constructions.

Table 2—6 Significance of effect due to entertainment noise from OVG

NSR #	Receiver sensitivity	Significance of effect
A – Properties along Stuart Street	High	Negligible
B – Properties along Gibbon Street	High	Negligible
C – Properties along Broxton Street	High	Negligible
D – Properties along Briscoe Lane	High	Negligible

3 Operational Noise from Crowd Noise

Guidance on the impact assessment of crowd noise associated with the Proposed Development is based on the magnitude of impact criteria outlined in Table 1—3 above.

Operational noise in the form of crowd noise is considered a long-term effect in this case.

To calculate the effect from crowd noise, an environmental 3D model has been created with CadnaA noise modelling software version 2019. Existing noise sources (roads and rail traffic) have been included in the model and it has been calibrated to the measured noise levels presented in Table 10.6. Known spectral sound power values for raised voices (taken from Building Bulletin 93 (BB93)) have been used within the noise model of the Proposed Development and surrounding area in order to predict noise levels at the nearest NSRs.

Raised voice sources have been placed in expected external congregation areas on the south and east boundaries of the Proposed Development within the noise model. Worst case noise levels from crowd noise is based on 10% of the 23,500-capacity arena speaking with a raised voice i.e. 2,350 No. of raised voices.

Crowd noise has been compared to baseline $L_{Aeq,T}$ daytime noise levels at Measurement Position 3. It is worth noting that baseline night-time $L_{Aeq,T}$ noise levels (as measured at the Long-term Measurement Position) are no greater than this, regardless. Modelled results presenting noise predictions without and with crowd noise can be seen in Figure 3—1 and Figure 3—2 respectively.

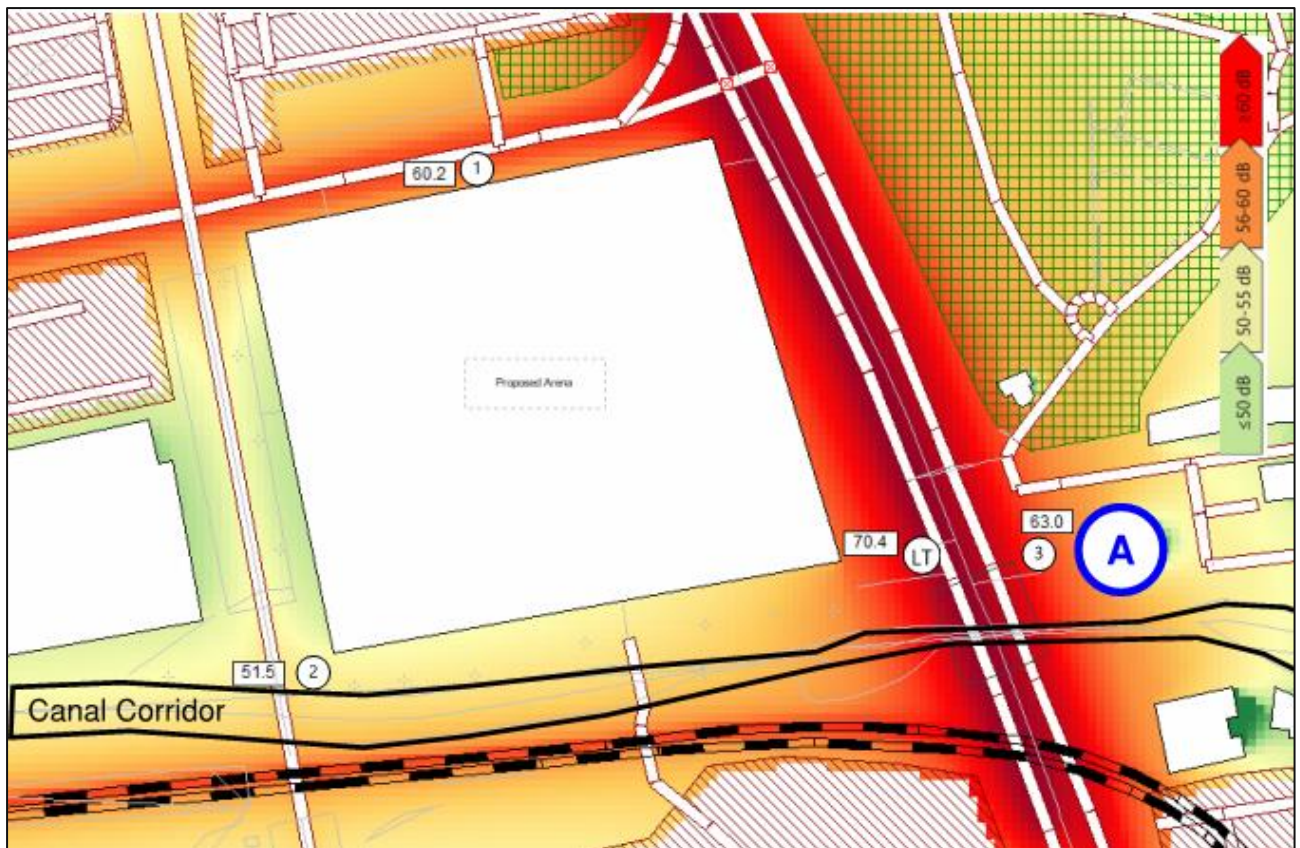


Figure 3—1 Baseline Noise Predictions without Crowd Noise

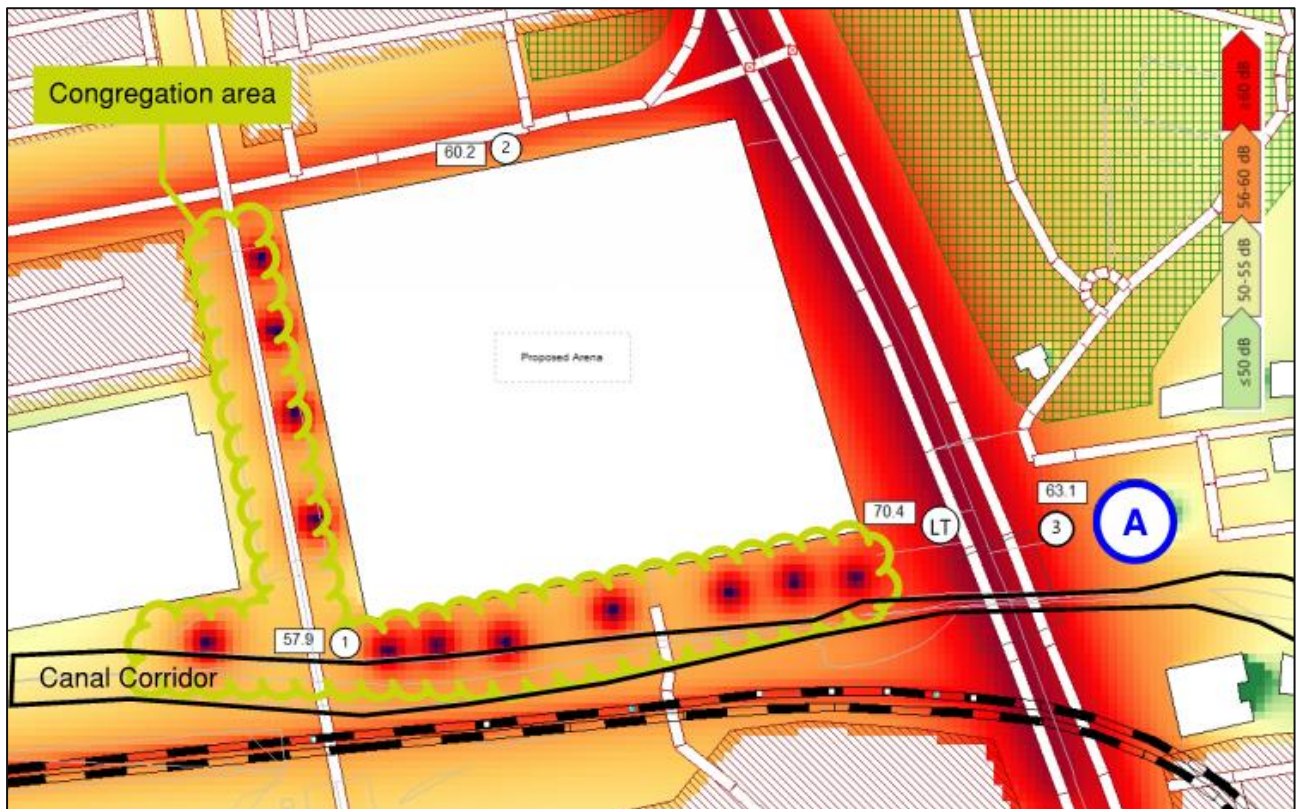


Figure 3—2 Noise Predictions with Crowd Noise

Furthermore, it can be seen in in Figure 3—1 and Figure 3—2 that crowd noise impact on the canal corridor is likely to be localised. As such, crowd noise is likely to be up to 6 dB above the baseline noise measurement of L_{Aeq} 51 dBA at ST-1 within a 10 m of large groups (approx. 200No.) of people. This is considered a medium magnitude of effect according to operational noise criteria; however, the closest noise sensitive receptor (NSR A) is located a considerable distance away and as shown in Figure 3—2 the predicted change in noise level at this location is only 0.1 dB, which has a negligible magnitude of impact and significance of effect.

Location ST-3 is considered to be representative of the NSR A location, therefore, these values have been reproduced in Table 3—1.

Table 3—1 Magnitude of impact from crowd noise

Measuring position	Baseline Noise Predictions without Crowd Noise (from Fig 3-1)	Noise Predictions with Crowd Noise (from Fig 3-2)	Predicted change in noise level - dB	Magnitude of impact
3	63.0	63.1	0.1	Negligible

Based on the predicted noise levels from crowd noise associated with the Proposed Development at each identified NSR the effect is summarised in Table 3—2.

Table 3—2 Significance of effect due to crowd noise

NSR #	Receiver sensitivity	Significance of effect
A – Properties along Stuart Street	High	Negligible
B – Properties along Gibbon Street	High	Negligible
C – Properties along Broxton Street	High	Negligible
D – Properties along Briscoe Lane	High	Negligible

4 Traffic Noise

This information is contained within Appendix 10.3 for construction-related traffic noise assessment and Appendix 10.4 for operational traffic noise assessment. Information has been reproduced below for completeness:

4.1 Construction Related Traffic Noise

Annual average weekday traffic (AAWT) flow counts were carried out by the project transport consultant. Observed and construction traffic flows have been used to assess the magnitude of impact on the NSRs on each road due to construction traffic at the peak construction years, as shown in Table 4—1.

Table 4—1 Magnitude of impact from construction traffic – 2021 (peak construction year)

Link	AAWT 2021 future baseline traffic flow		AAWT 2021 (future baseline + construction)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
Bradford Road (west of Saxon Street)	13241	8%	13241	8%	0.0	No change
Briscoe Lane (west of Riverpark Road)	17442	9%	17442	9%	0.0	No change
Stuart Lane (east of Archer Street)	5060	3%	5060	3%	0.0	No change
Gibbon Street (east of Alan Turing Way)	13726	4%	13726	4%	0.0	No change
A6010 Alan Turing Way (south of Gibbon Street)	32150	11%	32251	12%	0.0	No change
A622 Ashton New Road (east of Alan Turing Way)	20431	8%	20451	8%	0.0	No change
A6010 Alan Turing Way (south of Ashton New Road)	30329	13%	30410	13%	0.0	No change
A622 Ashton New Road (west of Grey Mare Lane)	18403	8%	18403	8%	0.0	No change
A6010 Alan Turing Way (north of Ashton Old Road)	28038	12%	28119	12%	0.1	Negligible
A635 Ashton Old Road (west of Mill Street)	25845	11%	25886	11%	0.0	No change
A6010 Pottery Lane (north of Ambrose Street)	29074	13%	29114	13%	0.0	No change
A635 Ashton Old Road (east Whitehurst Drive)	23787	12%	23787	12%	0.0	No change
Welcomb Street (north of Whitworth Street)	2309	15%	2309	15%	0.0	No change
A622 Ashton New Road (east of Linfield Street)	14883	9%	14903	9%	0.0	No change
A635 Ashton Old Road (west of Louisa Street)	24422	9%	24463	10%	0.0	No change

Link	AAWT 2021 future baseline traffic flow		AAWT 2021 (future baseline + construction)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
Ashton Old Road (east of Lime Bank Street)	29262	10%	29262	10%	0.0	No change
A662 Ashton New Road (west of Hillkirk Street)	14221	9%	14221	9%	0.0	No change

The table above shows no change to negligible magnitude of impact at these roads; therefore, the significance of effect from traffic noise generated by construction activities at all highly sensitive NSRs is calculated to be negligible, as shown in Table 4—2.

Table 4—2 Significance of effect at NSRs from construction traffic

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

4.2 Operational Traffic Noise

Annual average weekday traffic (AAWT) flow counts were carried out by the project transport consultant. Observed and predicted traffic flows have been used to assess the magnitude of impact on the roads due to operational traffic in the short and long-term, as shown in the following Tables.

Furthermore, traffic data has been provided with mode splits described as follows:

- The Base Mode split is worst case assuming no transport mitigation is applied; and
- The Aspirational Mode split has been derived assuming that transport mitigation to reduce car travel is applied.

Table 4—3 Magnitude of impact from operational traffic – 2026 Base Mode

Link	AAWT 2026 future baseline traffic flow		AAWT 2026 (Base Mode – future baseline + development – 180 events)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
Bradford Road (west of Saxon Street)	13979	8%	13942	8%	0.0	Negligible
Briscoe Lane (west of Riverpark Road)	18414	9%	18227	9%	0.0	Negligible
Stuart Lane (east of Archer Street)	5342	3%	5162	3%	0.0	Negligible
Gibbon Street (east of Alan Turing Way)	14491	4%	14267	4%	0.0	Negligible
A6010 Alan Turing Way (south of Gibbon Street)	33943	11%	35505	11%	0.2	Negligible

Link	AAWT 2026 future baseline traffic flow		AAWT 2026 (Base Mode – future baseline + development – 180 events)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
A622 Ashton New Road (east of Alan Turing Way)	21570	8%	21223	8%	0.0	Negligible
A6010 Alan Turing Way (south of Ashton New Road)	32020	13%	32890	12%	0.1	Negligible
A622 Ashton New Road (west of Grey Mare Lane)	19429	8%	19154	8%	0.0	Negligible
A6010 Alan Turing Way (north of Ashton Old Road)	29602	12%	30552	11%	0.1	Negligible
A635 Ashton Old Road (west of Mill Street)	27286	11%	26774	11%	0.0	Negligible
A6010 Pottery Lane (north of Ambrose Street)	30695	13%	30798	13%	0.1	Negligible
A635 Ashton Old Road (east Whitehurst Drive)	25114	12%	24674	12%	0.0	Negligible
Welcomb Street (north of Whitworth Street)	2438	15%	2356	15%	0.0	Negligible
A622 Ashton New Road (east of Linfield Street)	15712	9%	15562	9%	0.0	Negligible
A635 Ashton Old Road (west of Louisa Street)	25784	9%	25322	9%	0.0	Negligible
Ashton Old Road (east of Lime Bank Street)	30894	10%	30287	10%	0.0	Negligible
A662 Ashton New Road (west of Hillkirk Street)	15014	9%	14887	9%	0.0	Negligible

Table 4—4 Magnitude of impact from operational traffic – 2026 Aspirational Mode

Link	AAWT 2026 future baseline traffic flow		AAWT 2026 (Aspirational Mode – future baseline + development – 180 events)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV	Aspirational Mode	Aspirational Mode
Bradford Road (west of Saxon Street)	13979	8%	14217	8%	0.1	Negligible
Briscoe Lane (west of Riverpark Road)	18414	9%	18652	9%	0.0	Negligible
Stuart Lane (east of Archer Street)	5342	3%	5342	3%	0.0	Negligible
Gibbon Street (east of Alan Turing Way)	14491	4%	14636	4%	0.0	Negligible
A6010 Alan Turing Way (south of Gibbon Street)	33943	11%	35428	11%	0.1	Negligible

Link	AAWT 2026 future baseline traffic flow		AAWT 2026 (Aspirational Mode – future baseline + development – 180 events)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV	Aspirational Mode	Aspirational Mode
A622 Ashton New Road (east of Alan Turing Way)	21570	8%	21778	8%	0.0	Negligible
A6010 Alan Turing Way (south of Ashton New Road)	32020	13%	33089	12%	0.2	Negligible
A622 Ashton New Road (west of Grey Mare Lane)	19429	8%	19637	8%	0.1	Negligible
A6010 Alan Turing Way (north of Ashton Old Road)	29602	12%	30671	11%	0.1	Negligible
A635 Ashton Old Road (west of Mill Street)	27286	11%	27509	11%	0.1	Negligible
A6010 Pottery Lane (north of Ambrose Street)	30695	13%	31318	13%	0.1	Negligible
A635 Ashton Old Road (east Whitehurst Drive)	25114	12%	25336	12%	0.0	Negligible
Welcomb Street (north of Whitworth Street)	2438	15%	2438	15%	0.0	Negligible
A622 Ashton New Road (east of Linfield Street)	15712	9%	15920	9%	0.1	Negligible
A635 Ashton Old Road (west of Louisa Street)	25784	9%	26007	9%	0.0	Negligible
Ashton Old Road (east of Lime Bank Street)	30894	10%	31132	10%	0.0	Negligible
A662 Ashton New Road (west of Hillkirk Street)	15014	9%	15222	9%	0.1	Negligible

Table 4—5 Magnitude of impact from operational traffic – 2038 Aspirational Mode

Link	AAWT 2038 future baseline traffic flow		AAWT 2038 (Aspirational Mode – future baseline + development – 180 events)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
Bradford Road (west of Saxon Street)	15476	8%	15714	8%	0.1	Negligible
Briscoe Lane (west of Riverpark Road)	20386	9%	20623	9%	0.0	Negligible
Stuart Lane (east of Archer Street)	5914	3%	5914	3%	0.0	Negligible
Gibbon Street (east of Alan Turing Way)	16042	4%	16187	4%	0.1	Negligible

Link	AAWT 2038 future baseline traffic flow		AAWT 2038 (Aspirational Mode – future baseline + development – 180 events)		Predicted change in traffic noise level - dB	Magnitude of impact
	Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
A6010 Alan Turing Way (south of Gibbon Street)	37577	11%	39062	11%	0.2	Negligible
A622 Ashton New Road (east of Alan Turing Way)	23879	8%	24087	8%	0.1	Negligible
A6010 Alan Turing Way (south of Ashton New Road)	35448	13%	36517	12%	0.1	Negligible
A622 Ashton New Road (west of Grey Mare Lane)	21509	8%	21717	8%	0.0	Negligible
A6010 Alan Turing Way (north of Ashton Old Road)	32770	12%	33839	11%	0.2	Negligible
A635 Ashton Old Road (west of Mill Street)	30207	11%	30430	11%	0.0	Negligible
A6010 Pottery Lane (north of Ambrose Street)	33981	13%	34604	13%	0.1	Negligible
A635 Ashton Old Road (east Whitehurst Drive)	27802	12%	28025	12%	0.0	Negligible
Welcomb Street (north of Whitworth Street)	2699	15%	2699	15%	0.0	Negligible
A622 Ashton New Road (east of Linfield Street)	17394	9%	17602	9%	0.0	Negligible
A635 Ashton Old Road (west of Louisa Street)	28544	9%	28767	9%	0.0	Negligible
Ashton Old Road (east of Lime Bank Street)	34201	10%	34439	10%	0.0	Negligible
A662 Ashton New Road (west of Hillkirk Street)	16621	9%	16829	9%	0.0	Negligible

The tables above show a negligible magnitude of impact at the surrounding NSRs and therefore the significance of effect from traffic noise generated by operational traffic at all highly sensitive NSRs is calculated to be negligible.

Table 4—6 Significance of effect at NSRs from operational traffic

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

5 Operational noise from fixed plant and equipment

The impact of noise from mechanical services and plant will be informed by BS4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' in-line with the following MCCTG criterion:

"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 5 dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location."

L_{A90,T} spectral noise levels to satisfy the MCC plant noise criterion have been taken from the Long-Term Measurement Position. It is observed that measured L_{Aeq,T} and L_{A90,T} noise levels at the Long-Term Measurement Position are similar on event and non-event days indicating that events at the Etihad have a minimal impact on overall daytime and night-time noise levels.

Table 5—1 presents an assessment of the range of recorded L_{A90,15min} values to derive the typical background noise level at the measured location. This assessment follows the guidance provided in MCC Noise and Planning guidance¹, Appendix A. It is acknowledged that the averaging of statistical values interferes with their mathematical basis; however, the value derived is considered to be a useful indicator of the representative background level.

Table 5—1 Typical background noise level at the measured location. Daytime assessment on the left, night-time assessment on the right

Daytime	L _{A90,15min}			P
	18/06/19	19/06/19	20/06/19	Arithmetic Average
07:00		60.7	60.9	60.8
07:15		60.2	60.9	60.6
07:30		62.0	61.4	61.7
07:45		61.5	61.7	61.6
08:00		60.6	60.6	60.6
08:15		61.5	61.9	61.7
08:30		59.1	62.6	60.9
08:45		60.8	62.5	61.7
09:00		60.2	60.3	60.3
09:15		60.3	62.5	61.4
09:30		59.3	61.5	60.4
09:45		58.5	58.2	58.4
10:00		60.6	59.2	59.9
10:15		58.9	58.0	58.5
10:30		58.5	59.2	58.9
10:45		58.3	59.1	58.7
11:00	56.8	57.7		57.3
11:15	54.4	56.3		55.4
11:30	57.0	55.4		56.2
11:45	57.2	56.9		57.1
12:00	55.0	56.7		55.9
12:15	55.1	59.0		57.1
12:30	57.1	57.1		57.1
12:45	55.4	58.5		57.0
13:00	57.7	58.0		57.9
13:15	57.1	57.7		57.4
13:30	57.4	58.3		57.9

Night-time	L _{A90,15min}		P
	18/06/19	19/06/19	Arithmetic Average
23:00	57.0	51.8	54.4
23:15	57.2	49.1	53.2
23:30	55.7	49.6	52.7
23:45	54.2	49.9	52.1
00:00	53.0	48.1	50.6
00:15	53.1	48.0	50.6
00:30	49.7	46.9	48.3
00:45	46.4	47.5	47.0
01:00	47.2	47.9	47.6
01:15	46.5	47.0	46.8
01:30	45.9	45.1	45.5
01:45	46.0	44.4	45.2
02:00	44.3	44.5	44.4
02:15	44.6	45.6	45.1
02:30	46.1	44.3	45.2
02:45	45.9	44.0	45.0
03:00	44.0	43.7	43.9
03:15	44.2	43.8	44.0
03:30	45.3	45.1	45.2
03:45	44.2	45.5	44.9
04:00	44.4	45.3	44.9
04:15	44.3	44.1	44.2
04:30	45.6	45.7	45.7
04:45	44.5	45.3	44.9
05:00	45.2	45.2	45.2
05:15	47.0	47.4	47.2
05:30	50.3	50.4	50.4

¹https://secure.manchester.gov.uk/downloads/download/5199/environmental_and_public_protection_information_for_developers

Daytime	LA90,15min			P
	18/06/19	19/06/19	20/06/19	Arithmetic Average
13:45	60.2	57.0		58.6
14:00	55.0	56.5		55.8
14:15	55.6	57.3		56.5
14:30	54.9	58.1		56.5
14:45	55.6	57.5		56.6
15:00	54.7	57.0		55.9
15:15	56.4	58.3		57.4
15:30	54.2	56.3		55.3
15:45	54.3	56.9		55.6
16:00	56.9	57.1		57.0
16:15	53.5	57.0		55.3
16:30	54.0	56.0		55.0
16:45	54.9	56.2		55.6
17:00	54.8	59.0		56.9
17:15	56.2	57.7		57.0
17:30	56.7	58.7		57.7
17:45	54.9	58.4		56.7
18:00	56.2	59.6		57.9
18:15	57.2	57.6		57.4
18:30	57.2	56.5		56.9
18:45	57.6	58.7		58.2
19:00	57.1	59.3		58.2
19:15	54.9	57.4		56.2
19:30	56.2	57.3		56.8
19:45	56.0	57.5		56.8
20:00	60.5	56.5		58.5
20:15	59.8	57.1		58.5
20:30	58.8	55.9		57.4
20:45	59.2	56.3		57.8
21:00	59.7	55.4		57.6
21:15	60.3	56.2		58.3
21:30	61.1	54.0		57.6
21:45	59.6	54.4		57.0
22:00	60.0	55.5		57.8
22:15	60.6	53.8		57.2
22:30	58.1	52.1		55.1
22:45	58.0	50.6		54.3
Arithmetic average column P				57.7
Minimum value column P				54.3
Maximum value column P				61.7
Mean value of full data set				57.7
Minimum value full data set				50.6
Maximum value full data set				62.6

Night-time	LA90,15min		P
	18/06/19	19/06/19	Arithmetic Average
05:45	50.9	52.2	51.6
06:00	51.6	52.7	52.2
06:15	55.5	54.3	54.9
06:30	57.7	54.9	56.3
06:45	59.7	58.2	59.0
Arithmetic average column P			48.4
Minimum value column P			43.9
Maximum value column P			59.0
Mean value of full data set			48.4
Minimum value full data set			43.7
Maximum value full data set			59.7

Typical night-time background

44 dB is taken as the typical night-time background level as it is the minimum value of the averaged individual 15 minute periods

Typical daytime background

54 dB is taken as the typical day-time background level as it is the minimum value of the averaged individual 15 minute periods

Operational noise in the form of fixed plant and equipment noise is considered a long-term effect in this case.

Rating levels are given in the table below in-line with MCC criteria. It should be noted that (as the selection of plant is not currently known) these rating levels do not include any required corrections for acoustically distinguishable features. On this basis, correction factors may need to be applied to final selections, to cover the effect of certain acoustic features such as the tonality, impulsivity and intermittency, in general accordance with BS 4142:2014+A1:2019.

Table 5—2 Typical background noise levels and limiting rating plant noise levels at NSRs

NSR	Typical daytime background noise level dBA (07:00-23:00)	Plant daytime rating limit at 1 metre from NSR Facades L_{A,r,Tr} dBA (07:00-23:00)	Typical night-time background noise level dBA (23:00-07:00)	Plant night-time rating limit at 1 metre from NSR Facades L_{A,r,Tr} dBA (23:00-07:00)
All	54	49	44	39

It should also be noted that the limits detailed above are for all items of plant operating simultaneously. If there are multiple plant units then the sound pressure level of each item would need to be lower in order to factor in the cumulative effect.

Assuming that all external plant is selected in accordance with the above, the effect on receptors is shown in Table 5—3.

Table 5—3 Significance of effect at NSRs from operational noise from fixed plant and equipment

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible