



Sports Direct

SPORTS DIRECT, MANCHESTER ARNDALE

Plant Noise Validation Testing





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Plant Noise Validation Testing

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1 INTRODUCTION

WSP has been instructed by Sports Direct to undertake post completion testing in order to discharge MCC's planning condition 3b of the consent (Manchester City Council Reference-133401/FO/2022).

The planning condition relates to the new mechanical services plant that is installed on the roof of the Arndale Centre, Manchester. The plant serves the newly refurbished Sports Direct within the centre.

A noise survey has been carried out to determine the impact of the noise emissions from the new plant, on the nearest noise sensitive receptors (NSR). Plant noise limits are based on the previous WSP assessment report¹ that detailed a desktop assessment of the new plant in line with the requirements of Manchester City Council.

¹ 70077799 R-AC-02 SD Manchester Arndale Report (R-AC-02) dated XX

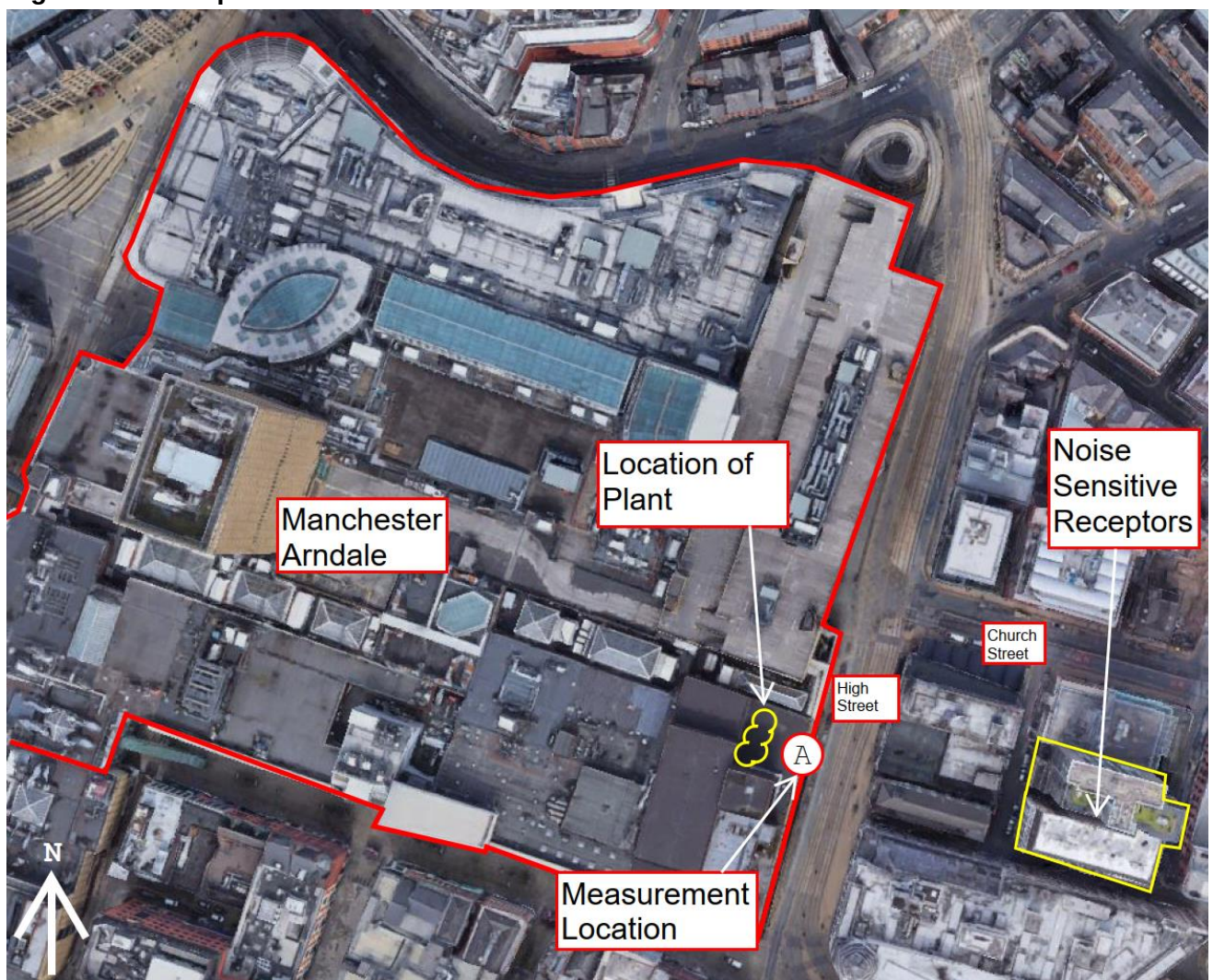
2 SITE DESCRIPTION & PROPOSED DEVELOPMENT

2.1 LOCATION

The new mechanical services plant that serves the new Sports Direct is located on the southeast rooftop of the Arndale Centre as seen in in Figure 2:1. The NSR are within the apartment buildings on the other side of Hight Street, highlighted in yellow on Figure 2:1.

The NSR are approximately 82m from the nearest item of plant located on the Arndale roof. There is no screening as both buildings are in direct line of sight to the proposed location for the new mechanical services plant. High street is a busy route through the city centre used by both vehicles and Metrolink trams. The road is also a busy pedestrian route.

Figure 2:1 - Site plan



The installed plant and model are presented in Table 2-1.

Table 2-1 – Installed plant items

Plant reference as seen in the rooftop site plan in Figure 2:2	Plant makes and models	
ODU-AHU-01	Daikin ERQ250AW1	
ODU-AHU-02	Daikin ERQ250AW1	
ODU-40-01	Daikin RYYQ32U	Condenser 1 (RYMQ16U)
		Condenser 2 (RYMQ16U)
ODU-40-02	Daikin RZAG71NV1	
ODU-45-01	Daikin RYYQ24U	Condenser 1 (RYMQ8U)
		Condenser 2 (RYMQ16U)
ODU-45-02	Daikin RZAG71NV1	
ODU-45-03	Daikin RZAG71NV1	
ODU-50-01	Daikin REYQ30U	Condenser 1 (RYMQ12U)
		Condenser 2 (RYMQ18U)
ODU-50-02	Daikin RZAG71NV1	
ODU-55-01	Daikin RYYQ40U	Condenser 1 (RYMQ10U)
		Condenser 2 (RYMQ12U)
		Condenser 3 (RYMQ18U)
ODU-55-02	Daikin RXM42R	
ODU-60-01	Daikin RYYQ36U	Condenser 1 (RYMQ16U)
		Condenser 2 (RYMQ20U)
ODU-60-02	Daikin RXM42R	
AHU01	Daikin ADT10FCD1-21-966779	

The locations of these plant items can be seen in Figure 2:2 and Figure 2:3

Figure 2:2 – Plant location plan



Figure 2:3 – Installed plant and measurement photograph



3 CRITERIA

3.1 MANCHESTER CITY COUNCIL

For this planning application (reference:133401/FO/2022), planning condition 3b of the decision notice of consent states that:

Prior to the plant becoming operational, a verification report shall be submitted to and approved in writing by the City Council as local planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed and full details of any measures required to ensure compliance with the agreed noise criteria shall be submitted to and agreed by the City Council as local planning authority within 5 months of the first operation of the scheme.

3.2 PLANT NOISE ASSESSMENT

Based on the requirements of MCC, WSP undertook a BS4142:2014 plant noise assessment (R-AC-02 SD) prior to the installation of the new mechanical services plant on the roof of the Arndale Centre. The assessment included determination of a background sound level and a calculated rating level at the NSR.

The measured background sound level at the NSR was **54dB L_{A90}** and therefore the resultant overall plant noise limit was **49dB L_{Af,Tr}** (5dB below the background as stipulated by MCC).

4 BASELINE NOISE SURVEY

4.1 OVERVIEW

Attended sound level measurements were undertaken on the Arndale roof between 1000h and 1100h on Wednesday 15 March 2023. The microphone was positioned approximately 1.5m above roof level and at least 1m from any reflecting surface. Measurement location A was at the boundary of the roof 10m from the nearest plant. Two 5 minute measurements were undertaken at this location: one with all the plant installed on the roof operating, and one with no plant operating. The plant was switched on and off by the mechanical services engineer on site.

As well as mechanical services plant noise, noise sources witnessed on-site included road traffic and the Metrolink on High Street.

4.2 WEATHER CONDITIONS

For the full measurement period the weather remained dry with temperatures ranging between 5-7°C. The wind speed was typically <5 m/s.

Weather conditions during both surveys were considered suitable for obtaining representative background sound levels.

4.3 MEASUREMENT EQUIPMENT

Details of the measurement equipment are provided in Appendix A.

4.4 MEASUREMENT RESULTS

A summary of the measured background sound levels is provided in Table 4:1, below.

Table 4:1 – Summary of measured sound levels at Location A

Plant Operating Status	Background (dB)
All Plant Operating	57 $L_{A90,5 \text{ mins}}$
No Plant Operating	56 $L_{A90,5 \text{ mins}}$

As seen in Table 4:1 the background sound level when all the plant is operating is only 1dB higher at the measurement location than when it is not operating.

5 ASSESSMENT

5.1 RATING LEVEL

Based on the sound level measured at location A when all plant was operating, and distance corrections to the NSR; a rating level has been calculated to determine the impact of the installed mechanical services plant at the NSR.

The calculation that was used for distance correction was:

$$L_{90} \text{ at } 90\text{m} = L_{90} \text{ at } 10\text{m} - \left(10 \log \left(\frac{82}{10}\right)\right)$$

There is a direct line of sight between the new items of plant and the NSRs, so no corrections for screening have been applied.

Rating corrections have been considered in accordance with BS 4142 procedures, but are not considered necessary due to the following:

- Tonality: Modern plant is not expected to exhibit any tonal characteristics
- Impulsivity: None of the proposed plant types are likely to produce impulsive sound due to having predominantly rotational mechanisms
- Intermittency: It has been assumed that all plant will be operational all of the time during the operating hours. Small variations in duty are likely to occur as demand fluctuates throughout the day, but these are expected to result in gradual sound level changes and are, therefore, unlikely to attract attention. As such, no rating correction has been applied for intermittency

On site observations of the plant operating confirm no rating corrections are necessary.

A summary of the calculation is provided in Table 5:1:

Table 5-1 – Calculation of rating level

Measured sound level at 10m from source with all plant operating $L_{A90, 5\text{mins}}$ (dB)	Approximate distance to the NSR (m)	Distance corrected specific sound level at the NSR $L_{Aeq,T}$ (dB)	Rating Corrections (dB)	Rating Level at NSR $L_{Ar,Tr}$ (dB)
57	82	48	0	48
Plant level limit				49

The calculated rating level at the NSR is 48dB $L_{Ar,Tr}$ which is 1dB below the plant level limit. Therefore, the plant installed on the roof of the Arndale has a low impact on the NSR and is in line with MCC's requirements.

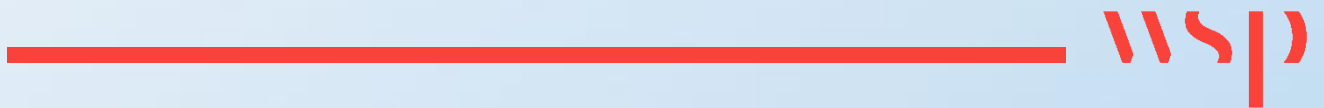
6 CONCLUSION

An environmental acoustic survey was carried out on the roof of the Arndale Centre, Manchester to validate the impact of the mechanical services plant serving Sports Direct.

Comparing the rating level to the plant noise limit it was found that the noise from the plant installed on the Andale roof has a low impact on the NSR and is in line with MCC's requirements.

Appendix A

SUMMARY OF NOISE MONITORING EQUIPMENT

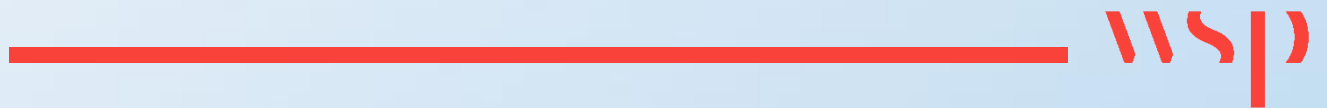




Measurement position	Equipment	Make/Model	Serial No.	Calibration due
A	Sound Level Meter	01dB-METRAVIB Black Solo	60531	09/12/2023
	Pre-amplifier	01dB-Metravib PRE 21 S	16422	
	Microphone	GRAS 40AE	333438	
	Calibrator	01dB-STEEL Cal 21	1558662	06/12/2023

Appendix B

TECHNICAL GLOSSARY



NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table 2 - Range of sound levels commonly found in the environment

Sound levels	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of pain

ACOUSTIC TERMINOLOGY

Terminology

Meaning

dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, 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} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

Appendix C

LIMITATIONS





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