



Sports Direct

SPORTS DIRECT, MANCHESTER ARNDALE

Plant Noise Assessment





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WSP

8 First Street

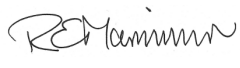
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1 INTRODUCTION

WSP has been instructed by Sports Direct to undertake a noise impact assessment in relation to the installation of new mechanical services plant on the roof of the Arndale Centre, Manchester. The plant will serve the proposed fit out of one of the commercial units within the centre.

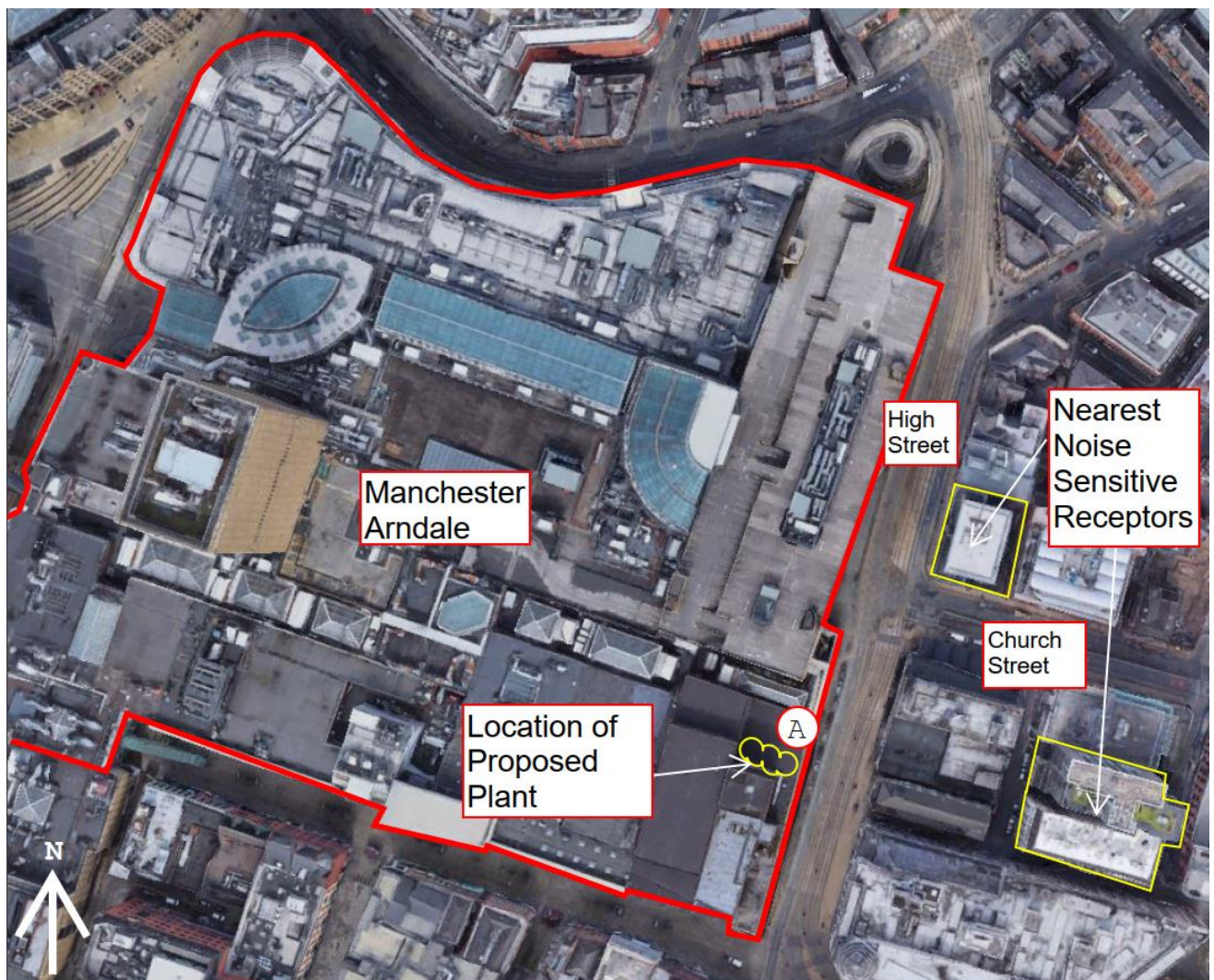
A 24 hour environmental noise survey has been carried out in order to determine the representative daytime background sound levels (L_{A90} , dB) at the nearest noise sensitive receptors (NSR). The measured background noise levels have been used to set limits from the proposed mechanical services plant in line with Manchester City Council's requirements.

2 SITE DESCRIPTION & PROPOSED DEVELOPMENT

2.1 LOCATION

The location for the new mechanical services plant that will serve the new Sports Direct will be located on the south east rooftop of the Arndale Centre as seen in in Figure 2:1. The nearest noise sensitive receptors are within the apartment buildings on the other side of High Street, highlighted in yellow on Figure 2:1. 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



2.2 PROPOSED PLANT

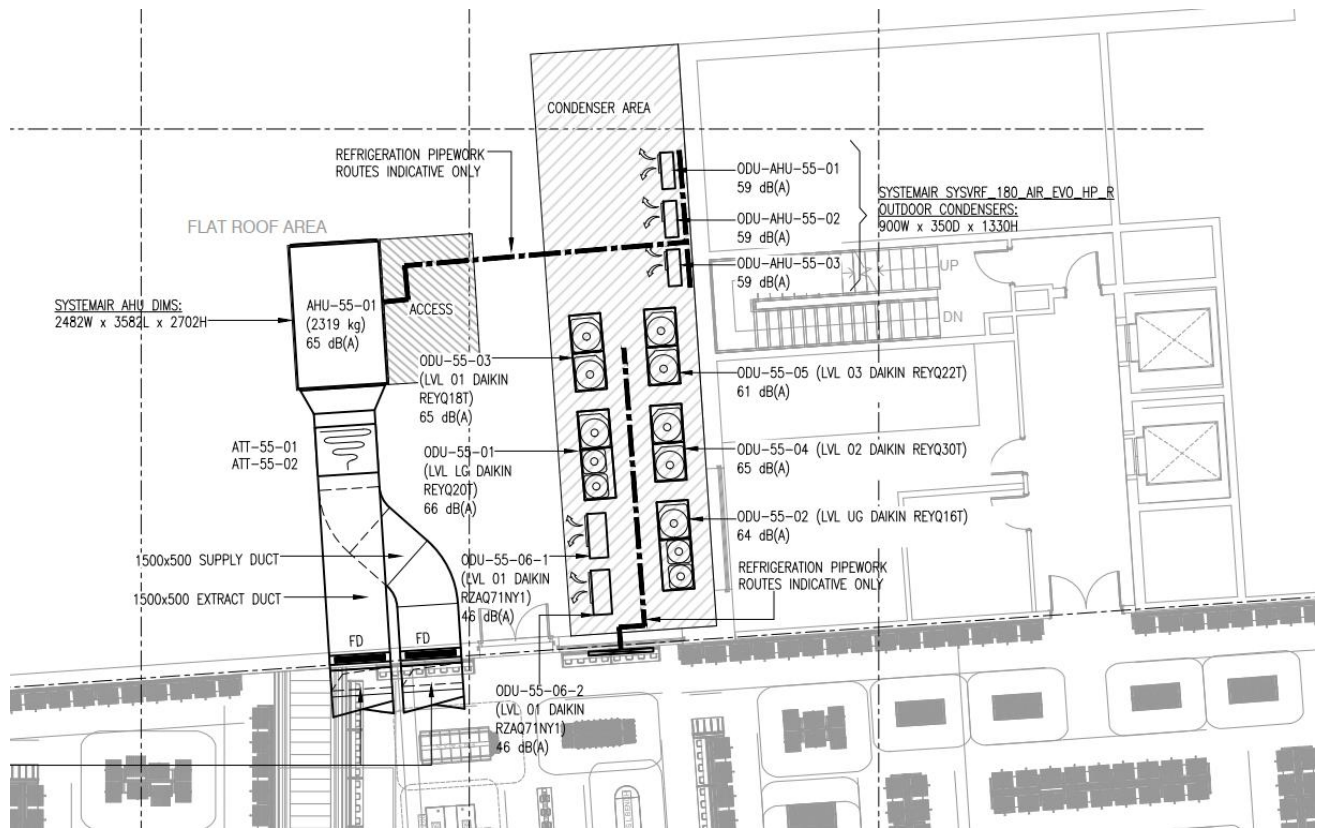
The mechanical services plant to be installed on the Arndale Centre's roof will comprise of the following items:

Table 2:1 – Proposed Plant Items and Sound Levels

Item		Sound Power Level, L _{WA} (dB)
Daikin REYQ18T ODU		86
Daikin REYQ20T ODU		88
Daikin RZAQ71NY1 ODU		64
Daikin RZAQ71NY1 ODU		64
Daikin REYQ16T ODU		86
Daikin REYQ30T ODU		87
Daikin REYQ22T ODU		83
Systemair SYSVRF 180 AIR EVO HP R ODU		74
Systemair SYSVRF 180 AIR EVO HP R ODU		74
Systemair SYSVRF 180 AIR EVO HP R ODU		74
Systemair Geniox 24 AHU	Outdoor Air (induct)	74
	Exhaust Air (induct)	88
	Sound Break Out	66

The sound power levels presented in Table 2:1 do not take into account any attenuation that may be used by the developer. The proposed locations of these items can be seen in Figure 2:2, below:

Figure 2:2 – Locations of Proposed Plant



It is understood that the proposed plant will only operate during the Arndale Centre's opening hours which are 0800-2000h, Monday – Saturday and 1130-1730h, Sundays.

3 CRITERIA

3.1 MANCHESTER CITY COUNCIL

Manchester City Council's *Planning & Noise Technical Guidance (December 2015)* requires that:

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 (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.

It notes that the rating level is to be determined based on the methodology set out in BS 4142:2014.

3.2 BS4142:2014 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND (+A1:2019)

BS 4142:2014 *Methods for rating and assessing industrial and commercial sound (+A1:2019)*, herein referred to as BS4142:2014 provides typical guidance for assessing noise emissions from new items of building services plant against the existing background noise level at the nearest noise sensitive receptors.

It states that if the noise rating level is ≥ 10 dB higher than the existing background noise level (L_{A90} dB), it provides a likely indication of a significant adverse impact. If the level is 5 dB above the existing background noise level, it provides a likely indication of an adverse impact. Where the level doesn't exceed the background noise level it is an indication of having a low impact.

It also identifies that where noise contains 'attention catching features' such as bangs, whistles, etc or is intermittent, penalties should be applied in the noise assessment.

4 BASELINE NOISE SURVEY

4.1 OVERVIEW

Unattended continuous long-term sound level measurements were undertaken at a single location (Location A) between 1230h, Tuesday 20 July 2021 to 1100h Wednesday 21 July 2021. The microphone positioned approximately 1.5m above roof level and at least 1m from any reflecting surface. The measurement location was chosen as it was deemed safe and secure and considered representative of the nearest noise sensitive receptors.

The dominant noise source was activity on High Street. This comprises road traffic noise, rail noise from the Metrolink and pedestrian noise. No mechanical services plant was operational in this part of the Arndale Centre's roof during the measurement period.

4.2 WEATHER CONDITIONS

For the full measurement period the weather remained dry with temperatures ranging between 14-26°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 & PERSONNEL

Details of the measurement equipment are provided in Appendix B.

Unattended noise monitoring equipment was installed and collected by Michael Ridley and James Evans.

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

Period	Background (dB) ¹
20/7/2021 (1230 – 2300h)	54 $L_{A90,1 \text{ hour}}$
20/7/2021, 21/7/2021 (2300 – 0700h)	44 $L_{A90,15 \text{ mins}}$
21/7/2021 (0700 – 1100)	54 $L_{A90,1 \text{ hour}}$

¹ Lowest L_{90} from the period as per the guidance in the MCC planning and noise document

Full details of the measured sound levels are provided in Appendix A.

5 ASSESSMENT

5.1 REPRESENTATIVE BACKGROUND LEVEL & PLANT LEVEL LIMIT

The representative background sound level ($L_{A90,T}$, dB) at the nearest noise sensitive receptors has been determined based the guidance in MCC's *Planning & Noise Technical Guidance (December 2015.)*

As the proposed plant will only operate during the Arndale Centre's opening hours, the arithmetic average for each time-period over the duration of the survey between 0800 – 2000h has been calculated. The minimum of the averages has then been used to determine the representative background sound level.

The representative background noise level is 54dB $L_{A90, 1 \text{ hour}}$.

As stated previously, MCC requires that the proposed plant meets a rating level that is 5dB below the representative background noise level. Therefore the plant level limit at the nearest noise sensitive receptors is 49dB $L_{Aeq,t}$.

5.2 RATING LEVEL

The rating level at the noise sensitive receptors has been calculated as the logarithmic addition of each individual plant type after being distance calculated from the location of the proposed plant to the nearest noise sensitive receptors.

Both apartment blocks identified as the nearest or most exposed NSRs are approximately 80m from the location of the proposed plant. Corrections for distance have been included in the calculation of the rating level.

There is a direct line of sight between the new items of plant and the NSRs, therefore, 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 specified and 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

A summary is provided in Table 5:1, below.

Table 5:1 – Determined rating level

Item		Sound Power Level, L_{WA} (dB)	Sound Pressure Level at the NNSR $L_{Aeq,t}$ (dB) ¹
Daikin REYQ18T ODU		86	40
Daikin REYQ20T ODU		88	42
Daikin RZAQ71NY1 ODU		64	18
Daikin RZAQ71NY1 ODU		64	18
Daikin REYQ16T ODU		86	40
Daikin REYQ30T ODU		87	41
Daikin REYQ22T ODU		83	37
Systemair SYSVRF 180 AIR EVO HP R ODU		74	28
Systemair SYSVRF 180 AIR EVO HP R ODU		74	28
Systemair SYSVRF 180 AIR EVO HP R ODU		74	28
Systemair Geniox 24 AHU	Outdoor Air (induct)	74	28
	Exhaust Air (induct)	88	42
	Sound Break Out	66	20
Rating Level			49 ²

¹Distance calculated over 80m.

²The logarithmic addition of the calculated sound pressure levels at the NSR taking in to consideration rating corrections as defined in BS 4142.

As seen in Table 5:1, the determined rating level is equal to the plant level limit, 5dB below the representative background level. This is in line with MCC requirements and indicates that the proposed plant will have a low impact on the nearest noise sensitive receptors.

6 CONCLUSION

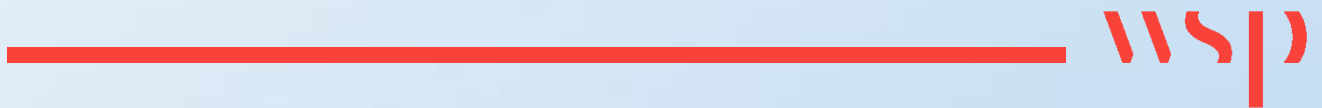
An environmental acoustic survey was carried out on the roof of the Arndale Centre, Manchester to form the basis of an acoustic assessment of the proposed mechanical services plant associated with the proposed Sports Direct in the Arndale Centre, in line with MCC's criteria.

The results of the survey were used to determine the existing background sound level at the nearest noise sensitive receptor.

Using sound data for the proposed plant, a rating level was calculated at the nearest noise sensitive receptor that is 5dB below the typical background sound level at the nearest noise sensitive receptor. This compliant with MCC's criteria for plant noise and is likely to result in a low impact on the receptors.

Appendix A

SUMMARY OF UNATTENDED NOISE MONITORING TO DETERMINE REPRESENTATIVE BACKGROUND NOISE LEVEL

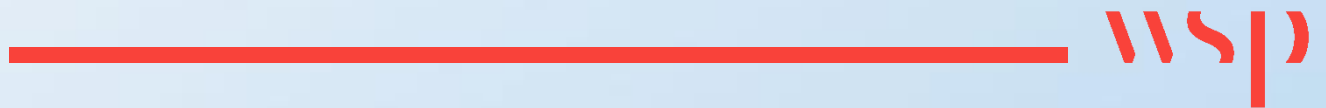


Period start	<i>L_{A90,1hour}</i>
12:30	57.1
13:30	57.1
14:30	57.4
15:30	57.4
16:30	56.8
17:30	55.7
18:30	55.2
19:30	53.6
20:30	52
21:30	52
22:30	52
23:30	49.7
00:30	48.6
01:30	49.1
02:30	49.1
03:30	44
04:30	44
05:30	45.3
06:30	51.7
07:30	53.9
08:30	55.5
09:30	57.9
10:30	58.2

Period start	<i>LA90,15minutes</i>	Period start	<i>LA90,15minutes</i>	Period start	<i>LA90,15minutes</i>
12:30	57.4	20:00	53.8	03:30	43.8
12:45	56.6	20:15	52.5	03:45	43.9
13:00	56.8	20:30	52.3	04:00	44.2
13:15	57.9	20:45	52.3	04:15	44.1
13:30	57.2	21:00	52.6	04:30	44.2
13:45	57.5	21:15	51.2	04:45	43.7
14:00	57.2	21:30	50.1	05:00	43.8
14:15	56.9	21:45	52.5	05:15	44.5
14:30	57.3	22:00	52.5	05:30	44.6
14:45	57.5	22:15	52.6	05:45	45
15:00	57.4	22:30	51.9	06:00	46
15:15	57.4	22:45	51.8	06:15	48.4
15:30	57.1	23:00	51.8	06:30	49.8
15:45	57.6	23:15	52.7	06:45	51.8
16:00	57.2	23:30	52	07:00	52.4
16:15	57.9	23:45	52.7	07:15	53.9
16:30	57.2	00:00	48.9	07:30	53.5
16:45	57.6	00:15	47.3	07:45	54
17:00	56.1	00:30	47.5	08:00	54.6
17:15	56.5	00:45	48.5	08:15	54.3
17:30	56.2	01:00	49.9	08:30	55.4
17:45	55.5	01:15	48.8	08:45	55.9
18:00	56	01:30	48.7	09:00	55.6
18:15	55.2	01:45	49.2	09:15	55.5
18:30	55.9	02:00	49.5	09:30	56.7
18:45	55.2	02:15	49.1	09:45	58.5
19:00	54.9	02:30	50.2	10:00	58.5
19:15	55.1	02:45	50	10:15	58
19:30	54.5	03:00	49	10:30	57.8
19:45	54.1	03:15	48.9	10:45	58

Appendix B

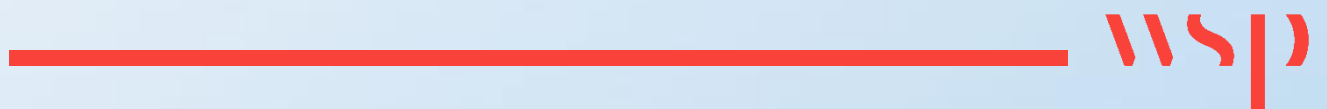
SUMMARY OF NOISE MONITORING EQUIPMENT



Measurement position	Equipment	Make/Model	Serial No.	Calibration due
A	Sound Level Meter	01dB-METRAVIB Black Solo 'Datalogging Integrating Sound Level Meter'	65804	08/02/2023
	Pre-amplifier	01dB-Metravib PRE 21 S	16471	
	Microphone	GRAS 40AE Microphone	425020	
	Calibrator	01dB-STEEL Cal 21 Sound Calibrator - London Float	35113823	08/02/2022

Appendix C

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 1 - 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 D

LIMITATIONS





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