

Manchester Metropolitan University, Institute of Sport

Noise Impact Assessment

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1.0

Introduction

1.0 Introduction

Cundall has been commissioned to undertake a noise impact assessment of items of fixed building plant servicing the Manchester Metropolitan University Institute of Sport (MMUIoS) development (hereafter referred to as 'the Development').

The Development is located at 99 Oxford Road in Manchester city centre and involves the partial demolition, reconfiguration and refurbishment of the existing Manchester Metropolitan University Student Union to create a new state-of-the-art Institute of Sports facility.

To assist with the noise impact calculations, sound power level data for the proposed new plant items has been inputted into a 3D site model created using SoundPLAN version 8.1 acoustic software.

The purpose of this assessment is to evaluate the findings of the 3D noise modelling exercise, in line with the requirements of the targeted SKA Higher Education (v1.0) measure and Condition 5a of the approved planning decision notice (Ref: 125466/FO/2019 - MMU IOS).

The scope of the assessment is based on the relevant technical guidance, good practice techniques and extensive previous experience of similar projects.

1.1 Revision P02 update (September 2021) – Post completion validation measurements

In accordance with the requirements of Condition 5b attached to the scheme, post-completion validation measurements have been undertaken at the Development to demonstrate that the plant noise emission limits have been achieved in-situ at the nearest noise-sensitive receptor.

The findings of these validation measurements are presented in Section 5.0 of this report.

2.0

Assessment criteria

2.0 Assessment criteria

This section of the report outlines the key legislation and guidance relevant to the assessment of noise for a development of this type.

2.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published by Defra in March 2010. This NPSE sets out the long-term vision of Government noise policy:

“Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.”

The NPSE long term vision is supported by the following aims:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.”*

2.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) was originally published in March 2012 and amended in July 2019. The NPPF is part of government reform to make the planning system less complex and more accessible, and to promote sustainable growth. It replaced existing national planning policies such as Planning Policy Guidance PPG24: Planning and Noise.

The NPPF states:

“170 - Planning policies and decisions should contribute to and enhance the natural and local environment by;

*e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or **noise pollution** or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;”*

and

“180 - Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;”*

2.3 Manchester City Council (MCC) planning requirements

Condition 5 of the approved decision notice (Ref: 125466/FO/2019 - MMU IOS) states the following with respect to cumulative noise emission limits to be achieved at 1 m from the nearest noise-sensitive receptors:

Condition 5

a) Any externally mounted ancillary equipment, plant and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.

"(b) Notwithstanding condition 2 and the above part a, prior to first operation of the plant (excluding testing) a verification report will be required, to be submitted to and approved in writing by the City Council as local planning authority, to validate that the work undertaken conforms to the above noise criteria. The report shall give the results of post-completion testing to confirm that the proposed noise limits are being achieved once the equipment and any mitigation measures have been installed. Any instances of non-conformity with the above criteria shall be detailed along with any measures required to ensure compliance.

The approved report and any necessary mitigation measures shall be implemented, and retained thereafter, in full in accordance with the approved details before the first occupation of the development.

2.4 SKA Higher Education (v1.0) – Pollution Issue D25

The Development is to be assessed under the SKA Higher Education (v1.0) environmental assessment method (2016).

Based on information contained in the MMIoS SKA tracker^[1] it is understood that two separate acoustics-related assessment measures have been targeted for the scheme, with one measure (D29) having already been awarded based on the RIBA Stage 3 design.

The criteria for the remaining Pollution D25 measure are reproduced below.

Criteria

Either a noise impact assessment in compliance with BS 4142:2014 is undertaken or the landlord/developer has previously commissioned a noise impact assessment in compliance with BS 4142:2014.

Either the report shows that new plant will not create a noise level more than 5dB above existing background noise levels or the report provides recommendations for acoustic insulation to ensure that any new installed plant will not create a noise level more than 5dB above existing background noise levels.

The installed plant and/or acoustic insulation meets the requirements of the report.

And

An acoustic assessment carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body ^[2], who demonstrates that plant noise does not raise the internal ambient noise levels or reverberation times ^[3] above those recommended in BB93, which includes recommendations to reduce noise levels to below or equal to recommended thresholds.

It can be seen from the above that the BS 4142 criterion for SKA measure D25 is less onerous than the requirements of Planning Condition 5. Compliance with the Planning Condition 5a should therefore see that the requirements of SKA measure D25 are achieved by default.

¹ MMIoS SKA tracker dated 07/02/2020

² The author, checker and verifier of this report are all full corporate members of the Institute of Acoustics (IoA) and are therefore classified as 'suitably qualified' for the purposes of SKA assessments.

³ Assessment of reverberation times has not been considered within this report – this is an error within the SKA rating criterion as there is no relationship between ambient noise and reverberation times.

3.0

Environmental noise surveys

3.0 Environmental noise surveys

3.1 Site Context

The proposed Development is located at 99 Oxford Road in Manchester city centre. The scheme involves the partial demolition, reconfiguration and refurbishment of the existing Manchester Metropolitan University Student Union building at 99 Oxford Road to create a new state-of-the-art Institute of Sports facility.

The site is bounded by the Mancunian Way (A57) to the north, Oxford Road to the west and Sidney Street to the south. Figure 1 provides an indication of the red line site boundary (red line).

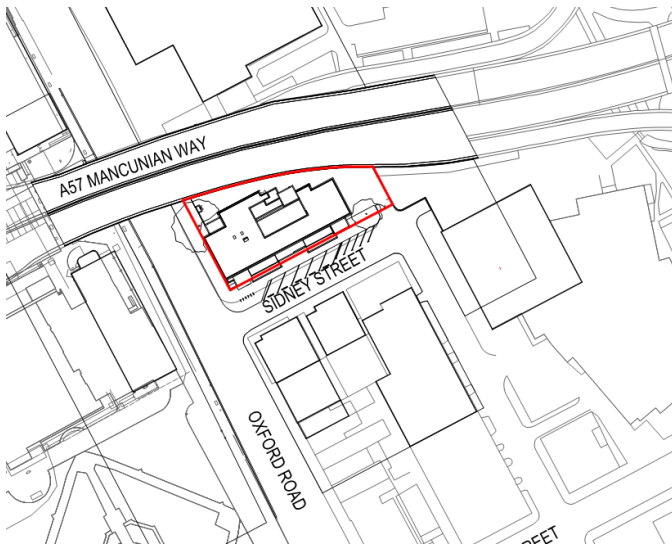


Figure 1 – Site map and nearest noise sensitive receptor (NSR)

It is understood that plant is to operate between the hours of 07:00 – 19:00.

3.1.1 Nearest noise-sensitive receptors

The nearest noise sensitive receptors (NSRs) to the Development (existing building in red outline) are apartments located on the opposite side of Sidney Street (orange outline).



Figure 2 – Nearest noise-sensitive receptors

3.2 BDP environmental noise survey

To assess prevailing levels of environmental noise affecting the proposed development and at nearby noise-sensitive receptors, short-term and long-term measurements were undertaken by BDP Acoustics (BDPA) in May 2019.

Full details of the environmental noise survey are details in BDPA report ref: MMU-AfG-BDP-XX-XX-RP-A-000003_P01 dated 21 June 2019. Relevant sections of the BDPA report are reproduced in the following subsections

3.2.1 Noise monitoring locations

The duration and purpose of each measurement position is summarised in Table 1. The approximate measurement locations are shown in Figure 3 below:

Survey position and period	Purpose
Long-term measurements at Position 5 & 6 between 09:00 on the 14th May 2019 and 14:30 hours on the 15th May 2019.	To understand the noise level variation on each façade to inform the building envelope design.
Manned measurements at Positions 1 to 4 between 09:00 and 13:00 hours on the 14th May 2019.	To measure noise levels at each façade over a 24-hour period to inform the building envelope design and for determination of daytime and night-time operational plant noise limits

Table 1 - Survey measurement positions (reproduced from Table 1 of report ref MMU-AfG-BDP-XX-XX-RP-A-000003_P01 dated 21 June 2019)

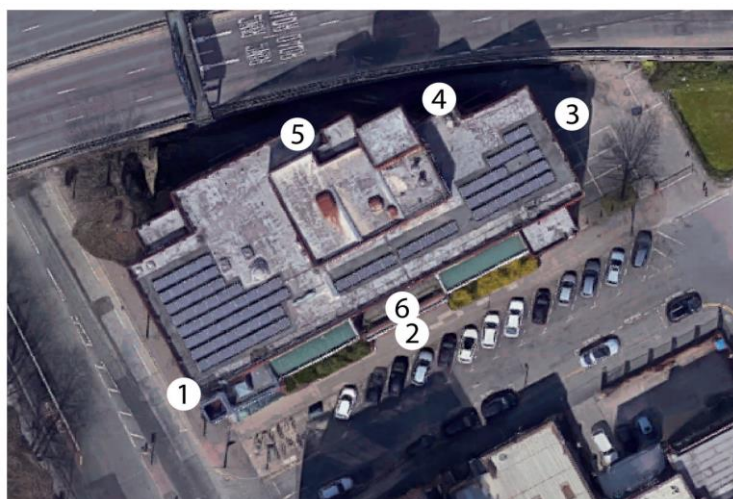


Figure 3 – Survey measurement positions (reproduced from Figure 2 of report ref MMU-AfG-BDP-XX-XX-RP-A-000003_P01 dated 21 June 2019)

A summary of BDPA's subjective impressions of the noise climate at each position is reproduced in Table A-1 of Appendix I to this report.

3.2.2 Summary of results

In the context of defining plant noise emission limits at the nearest noise-sensitive receptors, measurements at Position 6 are considered most representative of the prevailing background noise climate. This is due to the following properties:

- Continuous logging measurements at Position 6 contain data for a full daytime assessment period (as opposed to short-term measurements at locations 1-4)
- Being positioned on the closest elevation to the noise-sensitive receptors (as opposed to Position 5 which is located closer to the A57(m) Mancunian Way)

A summary of daytime measurements at Position 6 is presented in Table 2 overleaf. A summary of results at other measurements is reproduced in Table A-2 of Appendix I to this report.

Measurement position	Duration	Range $L_{Aeq,15min}$ dB	Range $L_{Amax,15min}$ dB	Range $L_{A90,15min}$ dB
Position 6	13 hours	62 – 72	67 - 97	60 – 65

Table 2 - Summary of measurement results at Position 6

3.3 Cundall environmental noise survey

Additional short-term measurements at the nearest noise-sensitive location were undertaken by Cundall in September 2020. The purpose of these measurements was to provide further validation of the BDPA environmental noise survey data.

Measurements were undertaken for a 1.5 hour period starting at approximately 10:15 hours on Friday 4 September 2020. This time was selected as the period is outside of morning / evening rush hours and is therefore considered broadly representative of the typical lowest background levels between 07:00 and 19:00 hours (i.e. during hours when new plant may be operational).

It was found that these Cundall validation measurements did not record any background levels lower than the 60 dB $L_{A90,15minutes}$ daytime value as recorded at Position 6 during the BDPA survey.

As such, this quietest daytime background level of 60 dB $L_{A90,15minutes}$ has been used to define the existing representative background noise climate in order to be representative of a robust worst-case assessment.

3.4 Proposed plant noise emission limit

Based on the above and the requirements of Condition 5a, Table 3 summarises the existing background noise levels measured at the site along with limiting noise levels for all new items of services plant, when measured at 1 m from the nearest noise sensitive receptor.

Plant operating period	Nearest noise-sensitive receptor	Representative background noise level dB L_{A90}	Plant noise rating level not to be exceeded at 1 m from nearest noise-sensitive receptor dB $L_{A,T,r}$
Daytime (07:00 – 19:00 hrs)	Apartments located on the opposite side of Sidney Street	60*	55
* Existing background noise value based on lowest measured $L_{A90,day(15min)}$ value at Position 6 during BDPA Survey			

Table 3 - Limiting rating noise levels for building services plant

The above limit is applicable to the cumulative noise level from all new items of plant when running under normal operation. Where applicable, acoustic feature corrections should be applied to the specific plant noise level to account for any distinguishable acoustic characteristics (e.g. tonality, impulsivity, intermittency).

4.0

Noise impact assessment

4.0 Noise impact assessment

4.1 Plant proposals

The primary items of noise generating plant that will serve the development are three air handling units (AHUs), two chillers and three condensers, all located at rooftop level. The manufacturers and model numbers for these units as provided by Ameon Building Services Engineers are given in the table below.

Item Description	Manufacturer and model number
AHU 01	Air Handlers - AHTW 2100-5050-FG-WP
AHU 02	Air Handlers - AHTW 2050-5050-FG-WP
AHU 03	Air Handlers - AHPHX 900-5050-FG-WP
2 x Chillers	Airedale – DCC032DR-06KLR0
3 x Condensers	Toshiba - RAV-GM2241AT8-E

Table 4 - Plant items

The location of these plant items has been based upon the following drawings:

- 1918-AME-XX-04-DR-M-500004 04 Roof Main – Ventilation Plant Room Layout (Sheet 1) Rev C02
- 1918-AME-XX-04-DR-M-500002 04 Roof Main Plant Room Rev C01

Extracts of these drawings are reproduced in Appendix II to this report.

4.1.1 AHU sound power data

Data provided by Ameon Building Services Engineering quotes the following sound power levels for AHUs. It should be noted that for extract and supply casings, manufacturer's data gives sound pressure levels as measured 1 m from the casing. Sound power levels have been calculated based on these levels assuming fully spherical radiating conditions.

AHU reference	Fan reference	Spectral sound power level, L_w (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
AHU 01	Supply Inlet	69	81	76	66	63	60	51	38
	Extract Outlet	68	74	72	74	74	73	70	66
	Supply Casing	65	77	58	47	43	50	40	30
	Extract Casing	59	64	49	47	44	48	41	32
AHU 02	Supply Inlet	69	80	74	65	62	59	50	36
	Extract Outlet	67	73	71	73	73	72	69	65
	Supply Casing	61	66	50	48	45	49	42	32
	Extract Casing	57	63	47	46	43	47	40	31

AHU reference	Fan reference	Spectral sound power level, L_w (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
AHU 03	Supply Inlet	70	59	63	55	53	45	39	35
	Extract Outlet	60	60	65	64	68	70	68	68
	Supply Casing	52	51	43	39	38	44	38	31
	Extract Casing	50	50	41	37	38	45	39	34

Table 5 - AHU noise data

4.1.2 Chiller units sound power data

The manufacturer's data for sound power level of the two chillers is as follows:

Spectral sound power level, L_w (dB)							
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
82.0	88.3	86.1	83.9	86.0	76.5	72.8	63.9

Table 6 - Chiller noise data

4.1.3 Condenser units sound pressure data

The manufacturer's data for sound pressure level of the three condensers is as follows:

Spectral sound pressure level @ 1 m L_{pA} (dB)							
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
41	50	61	55	56	52	46	38

Table 7 - Condenser noise data

4.2 Assessment procedure

To determine plant noise propagation to the nearest effected residential properties, a model has been produced using SoundPLAN 8.1 acoustic modelling software. This model is capable of accurately determining sound propagation by considering variations in topography, barrier attenuation provided by plant screening, and distance attenuation.

Using the information as listed in Table 4 to Table 7, the noise propagation to the facades of the nearest noise has been calculated.

A façade noise map indicating the calculated plant noise levels at the nearest noise sensitive windows is indicated in Figure 4 below.

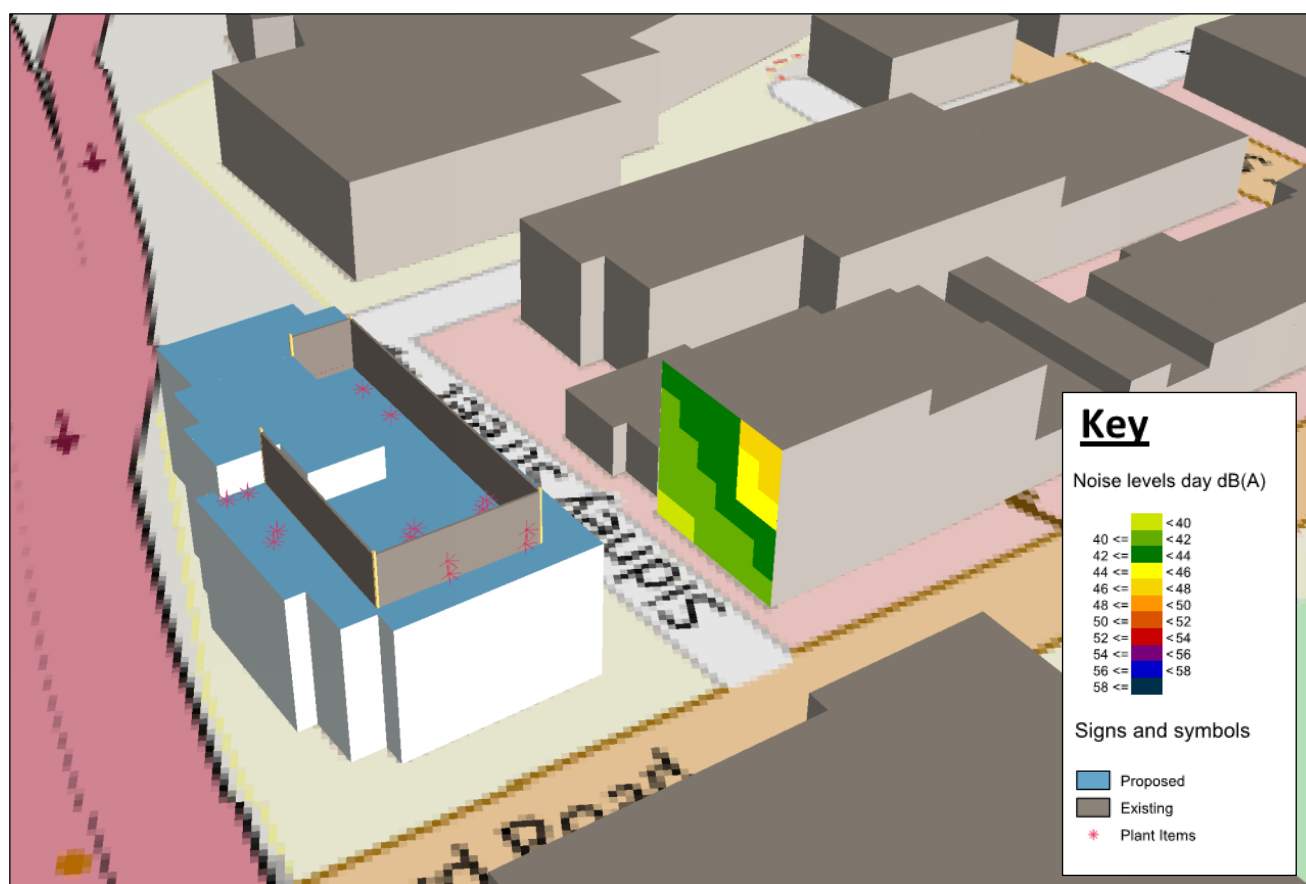


Figure 4 – Facade noise map

From the results presented in the figure above it can be seen that maximum predicted plant noise levels at 1m from the nearest noise-sensitive façade is 47 dB L_{Aeq} .

4.3 Results summary

The summary of the worst-case calculated levels with reference to the requirements of Planning Condition 5a is presented in the following table.

Lowest daytime background noise level, $L_{A90,T}$ dB	Condition 5a plant noise limit at 1m from façade of nearest noise-sensitive receptor, $L_{A,r,Tr}$ dB	Worst case calculated cumulative specific sound level, L_{Aeq} dB	Acoustic feature correction*, dB	Calculated rating level at noise-sensitive receptors, $L_{A,r,Tr}$ dB	Assessment outcome
60	55	47	+5	52	3 dB below requirements of Planning Condition 5a

* Based on a +2 dB correction for “just perceptible” tonality and +3 dB correction for intermittency

Table 8 - Plant noise assessment results

As can be seen from the results detailed above, the worst-case level of sound impact due to new building services plant associated with the redevelopment is predicted to be at least 3 dB below the proposed rating level limits at the nearest noise-sensitive façade.

5.0

Post-completion validation measurements

5.0 Post-completion validation measurements

In accordance with the requirements of Condition 5b attached to the scheme, post-completion validation measurements were undertaken by Cundall at the Development on 23 September 2021.

As it was not practicable to undertake background measurements at the nearest noise sensitive receptor (the most exposed apartment at Sydney Street is at 5th floor level), measurements were instead undertaken at the perimeter of the MMU IoS roof. Measurements were taken at approximately 11:00 hours once road traffic flows had reduced following the rush hour period.

The findings of these post-completion measurements are presented in the following subsections.

5.1 Measurements at rooftop position closest to NSR

In order to establish any changes to the ambient noise climate as a result of new external services plant, continuous logging noise measurements were undertaken during the following process:

- Measurement started with all external plant items switch OFF
- All external plant items switched ON in succession
- Measurement completed once all plant confirmed to be operating at typical design duty (approximately 6minutes from start of measurement)

The switching on of rooftop plant items was overseen by Ameen Ltd. (the project's MEP contractor) and it was confirmed that by the end of the process, all plant items were running at their typical design duties.

Measurements were undertaken at a single rooftop position considered most representative of the nearest noise-sensitive receptor, as shown in Figure 5 below. A photograph of the roof top measurement location is provided in Appendix III of this report.

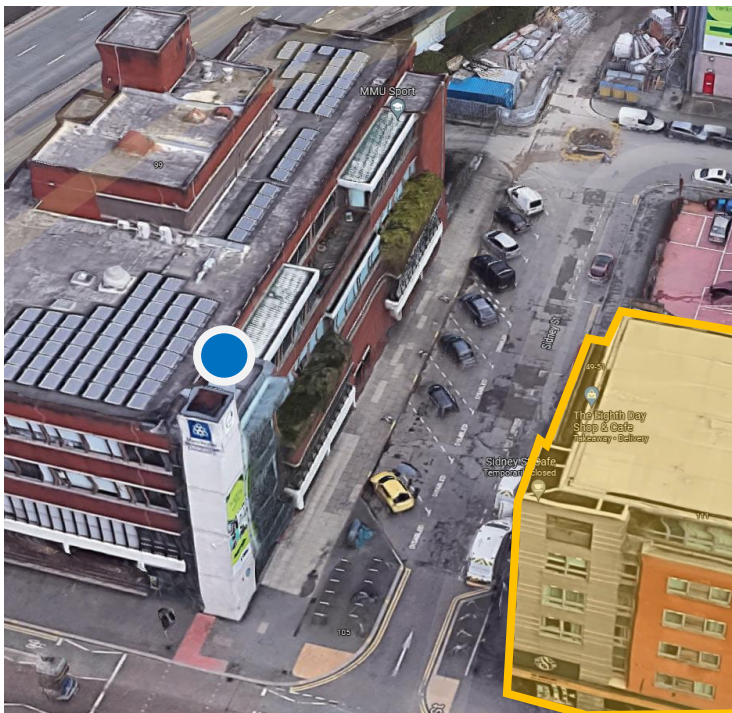


Figure 5 – Approximate monitoring position (blue) during plant item switch-on. (note: outdated aerial photograph shows MMU building prior to refurbishment works)

The following figures present the continuous logging results during the plant switch-on exercise ($L_{Aeq,dT}$ set to 1 second periods, L_{A90} set to 1 minute periods) and a spectrogram of the measured frequency content.

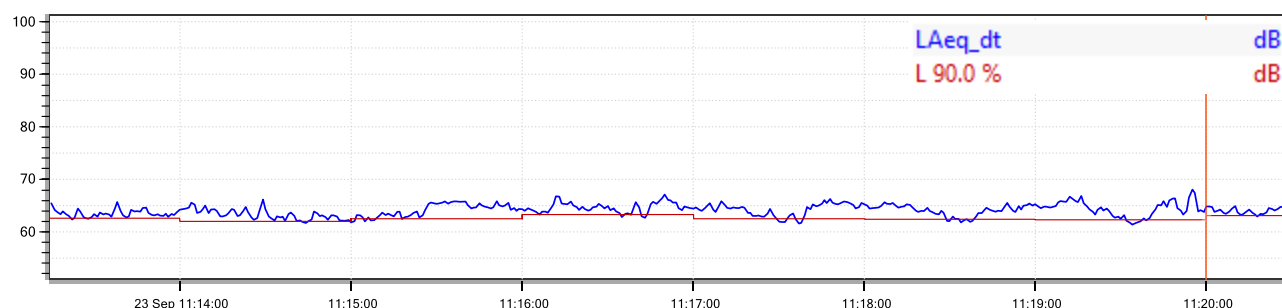


Figure 6 – $L_{Aeq,dT}$ and $L_{A90,1min}$ values during external plant switch on

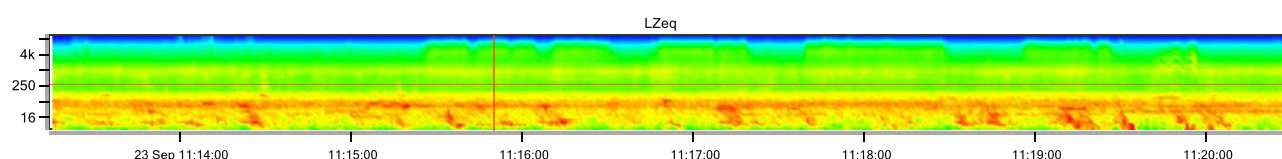


Figure 7 – Spectrogram during external plant switch on

It can be seen from Figure 6 that during the switch on of external plant, there was no discernible change to either the $L_{Aeq,dT}$ or $L_{A90,1min}$ values measured. This was in line with subjective impressions that plant noise contributions at the rooftop measurement locations were lower than the 62 dB L_{A90} background sound climate.

Furthermore, the spectrogram results in Figure 7 demonstrate that any change in tonality to the ambient sound environment at the rooftop measurement location was negligible and not perceptible.

5.2 Source level measurements

Once all plant was operational, additional source level measurements were also undertaken at a distance of 1 m from external plant items, where possible.

Lowest daytime background noise level, $L_{A90,T}$ dB	Measured sound pressure level at 1 m from plant item - $L_{Aeq,T}$ (dB)
AHU 01	Not possible to obtain accurate source level measurements as plant noise emissions were heavily masked by background noise from Oxford Road and A57 Mancunian Way
AHU 02	
AHU 03	
3 x Condensers	
Chiller 1	70 dB*
Chiller 2	70 dB*
* This is a worst-case value as both measurements contain noise contributions from one another due to the proximity of the units – see Appendix III	

Table 9 – Source level measurements of external plant items

Once the effects of distance attenuation are also taken into consideration, Table 10 overleaf presents a revised BS 4142 assessment based on source levels of plant items in operation.

Plant item / sound pressure level @ 1m	Distance attenuation to NSR	Cumulative specific sound level for all plant items at NSR, $L_{Aeq,T}$ dB	Acoustic feature correction**, dB	Rating level at NSR, $L_{Ar,Tr}$ dB	MCC plant noise emission target	Assessment outcome
AHU 01* 60 dB L_p @ 1m	-30 dB (based on 32 m distance)	45	+3	48	55 dB (i.e. 5 dB below representative background value of 60 dB)	Pass 7 dB below MCC criterion
AHU 02* 60 dB L_p @ 1m	-28 dB (based on 25 m distance)					
AHU 03* 60 dB L_p @ 1m	-32 dB (based on 42 m distance)					
3 x Condensers* 60 dB L_p @ 1m	-30 dB (based on 33 m distance)					
Chiller 1 70 dB L_p @ 1m	-29 dB (based on 27 m distance)					
Chiller 2 70 dB L_p @ 1m	-29 dB (based on 29 m distance)					
* In the absence of accurate in-situ source level data, a value of 60 dB has been selected as a worst case potential value						
** +3 dB correction for intermittency (no correction deemed necessary for tonality)						

Table 10 – BS 4142 assessment

As can be seen from the above, the calculated Rating Level at the NSR is comfortably lower than the MCC criterion.

5.3 Summary of post-completion validation measurements

Attended noise measurements have been undertaken at the roof and have determined the following:

- Measurements at the perimeter of the MMU IoS rooftop during a plant switch-on exercise have identified that the change in the ambient noise climate as a result of new external plant items was negligible. This is a positive indication that the resultant noise impacts at the nearest NSR will also be negligible.
- Source level measurements of plant items operating at typical duty levels have also been undertaken, where practicable. Once the effects of distance attenuation are taken into consideration, it can be seen that noise impact from external plant items at the façade of the NSR is significantly lower than the MCC plant noise limits identified in Table 3.

6.0

Conclusions

6.0 Conclusions

An assessment of the potential sound impact due to the proposed new external plant associated with the new MMUIoS development has been carried out.

This assessment has been based on plant noise level data and location plans supplied to Cundall by Ameen Ltd.

Calculations carried out in the acoustic modelling software SoundPLAN show that plant selections and attenuation proposals meet the plant noise emission limiting criteria as defined in Condition 5a attached to the scheme.

In accordance with the requirements of Condition 5b, post-completion measurements of the installed plant items operating at typical design duty have been undertaken and have demonstrated that the noise limits have been achieved in-situ.

Compliance with the external noise limit requirements of SKA Higher Education (v1.0) measure Pollution D25 has also been demonstrated.

Appendices

Appendix I BDP noise survey data

Summary of BDP noise survey data as detailed in MMU-AfG-BDP-XX-XX-RP-A-000003_P01 dated 21 June 2019

Measurement Position	Description
1	Attended position by the South-West façade of the existing building. The ambient noise levels at this position were dominated by noise resulting from road traffic on Oxford Road, with road traffic on the A57(M) also contributing.
2	Attended position by the South façade of the existing building. The ambient noise levels at this position were dominated by noise resulting from road traffic on Oxford Road, with road traffic on the A57(M) also contributing.
3	Attended position in the service yard of the existing site. The ambient noise levels at this position were dominated by noise resulting from a construction site to the North of the site and with road traffic on the A57(M) also contributing.
4	Attended position in the service yard of the existing site. The ambient noise levels at this position were dominated by noise resulting from a construction site to the North of the site and with road traffic on the A57(M) also contributing.
5	Unattended position on the North roof of the existing building. Measurements at this location were continuously logged over a 24 hour survey period. The ambient noise levels at this position were dominated by noise resulting from road traffic on the A57(M).
6	Unattended position on the South balcony of the existing building. Measurements at this location were continuously logged over a 24 hour survey period. The ambient noise levels at this position were dominated by noise resulting from road traffic on Oxford Road with road traffic on the A57(M) also contributing.

Table 2: Description of measurement positions and noise climate

Table A-1 - Description of measurements positions and noise climate

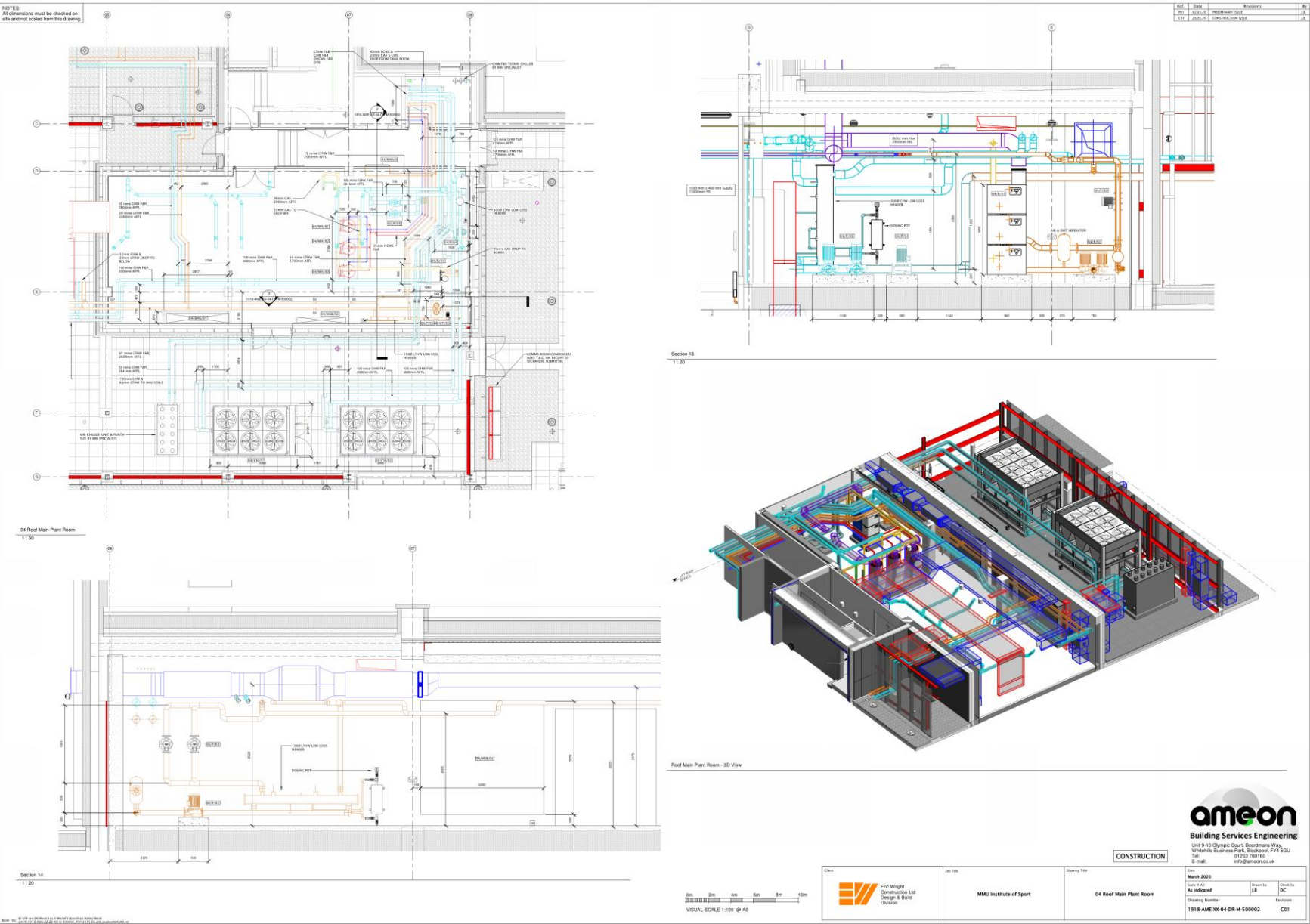
Measurement Position	Start time (dd/mm/yyyy hh:mm)	Duration	L _{Aeq,5mins} Range (dB)	L _{AFmax,5mins} Range (dB)	L _{A90,5mins} Range (dB)
1	09:01:07	15 minutes	71	81 - 84	64
1	09:36:18	15 minutes	70 - 72	81 - 85	63 - 64
1	10:09:06	15 minutes	70 - 72	83 - 93	63 - 64
1	10:41:57	15 minutes	71	82 - 87	63 - 65
2	09:18:23	15 minutes	62 - 65	72 - 78	59 - 60
2	09:52:55	15 minutes	64 - 72	74 - 98	59 - 60
2	10:25:36	15 minutes	64 - 74	76 - 96	61
3	11:14:26	15 minutes	69 - 74	78 - 87	66 - 69
4	11:35:37	15 minutes	71 - 73	80 - 83	67 - 70
5	10:05:00	14 hours	76 - 82	80 - 104	71 - 82
5	23:00:00	8 hours	70 - 82	81 - 100	53 - 82
6	10:50:00	13 hours	62 - 72	67 - 97	60 - 65
6	23:00:00	8 hours	59 - 68	66 - 85	47 - 66

Table 3: Summary of measurement results

Table A-2 – Summary of measurement results

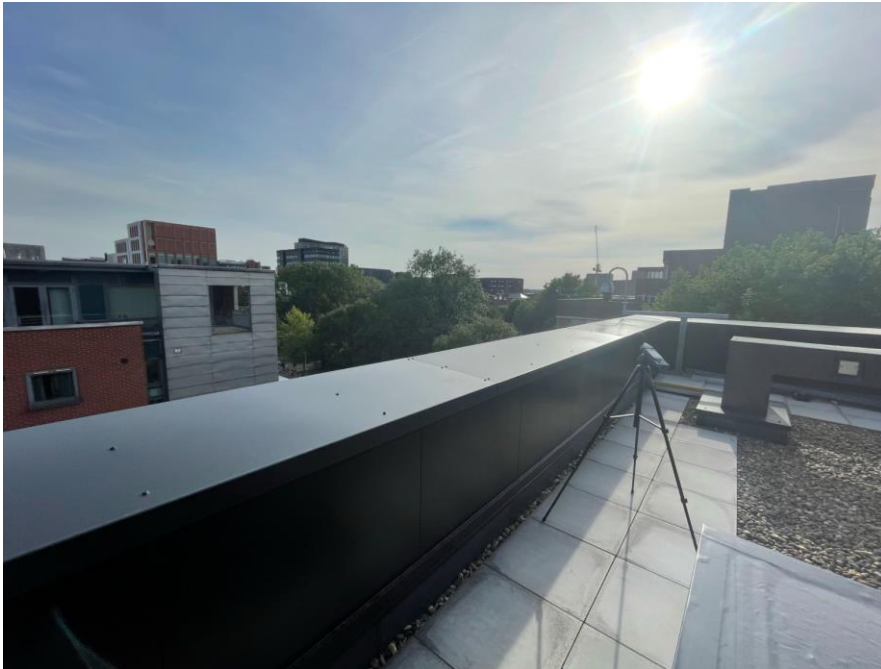
Document Ref. MMUIOS-CDL-XX-XX-SU-AS-45100





Appendix III Images of post completion validation measurements

Photograph of SLM at rooftop position closest to NSR during switch-on of external plant



Photograph of SLM for source level measurement adjacent to Chiller 1



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