



Consultants in Sound and Vibration

Report

19-0010-R3

8 January 2021

Moxy Hotel, Manchester

Environmental Noise Survey

BY Acoustics

105 Woodlands Avenue
West Byfleet
Surrey, KT14 6AP

E Office@byacoustics.com

T +44 1932 932038

www.byacoustics.com

Registered in England and Wales no. 12165927

Revision Number	Date	Comments	Author	Approved by
0	08/01/2021	First Issue	Johnny Berrill	Ian Yates

Prepared by

BY Acoustics

On behalf of:

Gilbert Ash

47 Boucher Road

Belfast

Co Antrim

BT12 6HR

Table of Contents

1	Introduction	1
2	Site Description	1
3	Plant Noise Limits	2
4	Plant Noise Assessment	3
4.1	Proposed Installation	3
4.2	Methodology	3
4.3	Mitigation Measures	4
4.4	Results	4
5	Emergency Generator	5
6	Vibration Control	6
7	Conclusion	6

Appendix A - Plant and Mitigation Information

19-0010-R3-SCH1: Plant Schedule

19-0010-R3-SCH2: Mitigation Schedule

19-0010-PA1: Plant Area plan showing plant locations and proposed mitigation measures

Glossary of Terms

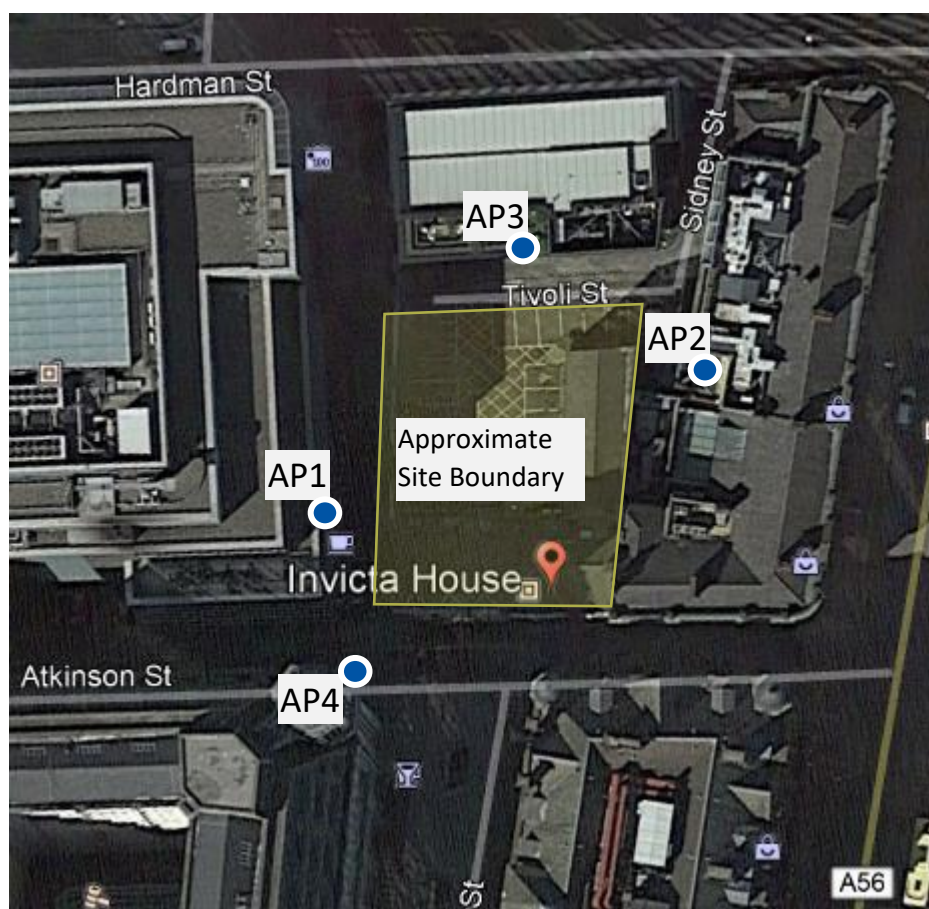


1 Introduction

- 1.1 Planning permission has been granted (Ref: 116164/FO/2017) for the development of a scheme providing hotel accommodation in Spinningfields, Manchester. The scheme includes the demolition of the existing Invicta House, with retention of some facade elements, to be replaced by a new eight storey hotel building. A number of conditions have been set, to be met/discharged prior to certain stages in the construction of the scheme.
- 1.2 This report relates to Planning Condition 14 which states:
“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 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.”
- 1.3 A plant noise assessment has been undertaken on the proposed mechanical services equipment associated with the hotel development. The assessment has been undertaken with reference to BY Acoustics report 19/0010/R1 which sets out the details of an environmental noise survey undertaken at the site.
- 1.4 This report details an evaluation of noise emissions from the proposed plant to the nearest noise sensitive receptors. Where necessary, mitigation measures have been set out with performance requirements for the various elements specified.

2 Site Description

- 2.1 The original Invicta House site is located at 2-4 Atkinson St, Manchester. The site is surrounded by commercial premises. It comprised a vacant, three-storey building, formerly used as offices, with car parking to the rear (accessed from Tivoli Street off Hardman Street, which is located to the north, beyond other commercial buildings). This building is now demolished, aside from the retained elements.
- 2.2 Atkinson Street forms the southern boundary and it carries little traffic; but the junction with the busy Deansgate is approximately 30 m east of the site. The western boundary is with a pedestrian walkway, which separates the site from the neighbouring building to the west.
- 2.3 The nearest noise sensitive receptors are described as follows and shown on F2.1 overleaf. It is understood that all buildings except for AP3 contain residential elements, therefore these buildings are considered sensitive receptors at all times. AP3 is an office building and is therefore not strictly considered a noise sensitive location under Manchester City policy DM1. However, to ensure a robust assessment and to reduce potential impact upon the users of the MediaCom building, this building will be considered a sensitive receptor for the plant items during daytime hours (e.g. 07h00 to 23h00). The noise levels calculated to this position at all times will be shown for reference.
 - AP1 – East façade of Scott Place
 - AP2 – West façade of Oddfellows House
 - AP3 – South façade of MediaCom building
 - AP4 – North façade, closest building to south of Atkinson St



F2.1 Site plan showing location of proposed development site (© Google)

3 Plant Noise Limits

- 3.1 Plant noise limits applicable to this site are set out in Section 3.3 of BY Acoustics report 19-0010-R1. These limits are re-stated with reference to the nearest noise sensitive receptors in the following Table 3.1.
- 3.2 The plant noise criteria apply at 1m from the nearest noise sensitive façade to each plant item. In accordance with BS 4142, corrections and penalties should be applied to account for the character of noise from the proposed plant items relative to the existing noise climate.

Location	Plant Noise Limit, dB $L_{Ar, T}$	
	Day (0700-2300)	Night (2300-0700)
AP1 – Scott Place	55	53
AP2 – Oddfellows House	50	45
AP3 – MediaCom Building	50	45
AP4 – South of Atkinson St	55	53

Table 3.1: Plant noise limits



- 3.3 These plant noise limits apply to the cumulative level from all plant items associated with the development.
- 3.4 It is also recommended that noise and vibration from plant items should be sufficiently controlled such that the overall noise level within bedrooms in the hotel does not exceed NR20. This is not covered in this report, as it will be the responsibility of other members of the project team.

4 Plant Noise Assessment

4.1 Proposed Installation

- 4.1.1 The proposed external units, and internal units ducted to atmosphere, are as set out in 19-0010-R3-SCH1 in the attached Appendix A. The plant information and locations have been assessed on the basis of information provided by Stothers. If any additional or alternative equipment is to be used relative to the plant set out in 19-0010-R3-SCH1 we should be advised and the assessment updated.
- 4.1.2 The plant is mostly located on the hotel roof with a weather louvre surround. The plant area is open to the top. MVHR units are in place in the bedrooms, being ducted out to the facades. These unit selections are not finalised yet; this report should be updated once they are selected. The MVHR units should be selected such that for each unit the combined inlet and outlet noise levels do not exceed 20 dB(A) at 5m from the external façade terminations with no tonality present, including the application of silencers where needed.
- 4.1.3 A rooftop emergency generator is also in place. This is not considered as part of the plant noise assessment, but is analysed separately in Section 5 below.
- 4.1.4 The locations of the plant items, along with specific mitigation measures proposed and recommended are set out in 19-0010-PA1 in Appendix A.
- 4.1.5 While some locations such as the ironing room are unlikely to be in use during night time hours, it is possible that all plant could run at any time during the day or night. Therefore, the assessment is undertaken on the basis of all plant items operating simultaneously.
- 4.1.6 Attainment of suitable internal noise levels is essential also; this is the responsibility of the M&E team.

4.2 Methodology

- 4.2.1 Our assessment has used manufacturer's noise data where possible for each plant item as shown in the attached schedule 19-0010-R3-SCH1. Where the data provided for any unit shows a risk of tonality being observed at the receptors a penalty is applied in accordance with BS 4142 as set out in the schedule.
- 4.2.2 We have calculated the noise levels generated by the proposed plant items to 1 metre from the façades of the nearest assessment positions as set out above. In all cases the assessment position is taken as a pessimistic location, i.e. façade location with minimum screening, distance etc from the plant items, to give a worst case assessed level.
- 4.2.3 All other noise sensitive receivers are at locations subject to substantially greater screening and are at a greater distance from the noise sources than the assessment position. Therefore, a



mitigation package which allows compliance at the stated assessment positions would also be expected to show compliance at all other noise sensitive receivers.

4.3 Mitigation Measures

- 4.3.1 The results of our assessment indicate that mitigation of noise emissions from most units will be required in order to meet the noise emission limits.
- 4.3.2 In order to provide attenuation, it is proposed that the western side of the rooftop plant surround be constructed using a solid screen. The solid sections should have a minimum mass of 15 kg/m^2 . The screen should follow the extent of that shown in the plant area plan 19-0010-PA1 attached in Appendix A.
- 4.3.3 The height of the solid screen should be such that it is equal to or greater than the top of the tallest unit on the rooftop, including the emergency generator. It should have no gaps or holes, being fitted with a tight seal at the base and at each junction.
- 4.3.4 It is likely that the solid screen can comprise a solid backing, such as thin steel, applied to the plant side of the proposed weather louvre surround. If this approach is taken, the minimum 15 kg/m^2 mass must be achieved with no gaps or holes between panels or at the base. An upstand or apron may be necessary to achieve this if a gap at the bottom is required for movement.
- 4.3.5 The rest of the plant surround should comprise a weather louvre, again rising to a height equal to or taller than the tallest unit on the rooftop.
- 4.3.6 In addition to this, the fans will require attenuation in the form of atmospheric side silencers. The attached silencer schedule 19-0010-R3-SCH2 sets out the performance of all silencers to be utilised as part of the mitigation package. This document is contained within Appendix A.

4.4 Results

- 4.4.1 The rating noise levels at each assessment position, calculated with the mitigation measures specified above, are shown in Table 4.1. Noise levels at more distant sensitive receivers or screened locations would be lower than those set out in the table below. Detailed calculation sheets can be provided on request.

Measurement Period / Assessment Location	Calculated Rating Level, dB L_{A,T_r}^* (Limit)			
	Day (0700-2300)		Night (2300-0700)	
AP1 – Scott Place	46	(55)	46	(53)
AP2 – Oddfellows House	42	(50)	42	(45)
AP3 – MediaCom Building	44	(50)	44	(45)
AP4 – South of Atkinson St	47	(55)	47	(53)

Table 4.1: Calculated plant rating levels;

* Time, $T_r = 1 \text{ hour}$ 0700-2300, $T_r = 15 \text{ minutes}$ 23h00-0700



5 Emergency Generator

- 5.1 As noted above, and seen in attached 19-0010-PA1, an emergency generator is located on the west side of the rooftop. The generator will be located inside the solid part of the plant surround. The generator will not be in contact with the surround at any point and will sit equal to or below the top of the surround at its highest point.
- 5.2 The emergency generator is rated to 76.3 dB(A) with a level 2 enclosure in place as proposed. Manufacturers data does not include octave band information, therefore a typical spectrum has been assumed for the generator. As seen in 19-0010-SCH2, a 4 dB penalty has been applied on the pessimistic assumption that a low frequency tone may be noticeable during operation of the generator.
- 5.3 There are no noise limits set by Manchester City Council for emergency plant items. Given their nature, to be operational only in emergency and during intermittent testing, limits are typically relaxed in comparison to fixed mechanical services plant noise limits and applicable only during times of testing. A limit of 10 dB above the prevailing background noise level is often set, applicable during testing.
- 5.4 Testing will only take place during the daytime, between 09h00 and 18h00. Therefore, noise limits for the emergency plant are based on the daytime background noise levels only. Testing should never take place outside of these hours.
- 5.5 The prevailing background noise level along Atkinson St is 60 dB $L_{A90,1hr}$ which would equate to a limit of 70 dB $L_{Ar, 1 hour}$. Receptors screened from Atkinson St would be subject to a limit of 65 dB $L_{Ar, 1 hour}$. 70 dB $L_{Ar, 1 hour}$ is considered a high noise level in absolute terms and so a reduced limit of 65 dB $L_{Ar, 1 hour}$ is recommended to receptors both along Atkinson St and screened from Atkinson St.
- 5.6 The rating noise level from the emergency generator at each assessment position has been calculated with the mitigation measures specified above. The results are shown in Table 5.1. Noise levels at more distant sensitive receivers or screened locations would be lower than those set out in the table below. Detailed calculation sheets can be provided on request.

Measurement Period / Assessment Location	Calculated Rating Level, dB $L_{Ar, 1 hour}$ * (Limit)			
	Day (0700-2300)		Night (2300-0700)	
AP1 – Scott Place	61	(65)	N/A	(N/A)
AP2 – Oddfellows House	51	(65)	N/A	(N/A)
AP3 – MediaCom Building	53	(65)	N/A	(N/A)
AP4 – South of Atkinson St	55	(65)	N/A	(N/A)

Table 5.1: Calculated emergency plant rating levels



6 Vibration Control

- 6.1 It will be necessary to control vibration from the roof mounted units in order to avoid structure-borne noise transfer into the hotel bedrooms.
- 6.2 The condenser units should be placed on rubber turret mounts, with a mount placed under each corner of the unit. The turret mounts for the condensers should be rated to provide a static deflection of 3mm under the weight of each unit. Where the units are on a platform system, such as a big foot system, the mounts can be placed under the frame feet, to provide isolation between the frame and the concrete roof slab providing a suitable static deflection is maintained.
- 6.3 Air Handling Units and fans should also be placed on rubber turret mounts. The mounts should be placed at each of the four corners of the unit, and along the outer frame between corners if additional support is required. The turret should be rated to have a static deflection of 8mm under the static loading of the unit.
- 6.4 In addition to this, it is necessary to control vibration transfer from internally mounted plant such as the MVHRs into the main structure. Units should be isolated from the structure in each bedroom. The proposed connection to the primary ceiling/structural frame and method of unit isolation should be submitted for our review.
- 6.5 All other plant with associated vibration, such as the sub-station and water pumps, should be suitably isolated from the structure.

7 Conclusion

- 7.1 It is proposed to undertake development works to provide hotel accommodation at the existing Invicta House, which is to be demolished with parts of the façade retained. As part of the development mechanical services plant items will be installed.
- 7.2 Noise mitigation measures have been recommended on the basis of a subsequent assessment of the proposed units and it has been shown that the limits set in line with planning condition 14 would be met at all times. Noise levels from the emergency generator would also meet recommended limits for emergency plant. With the installation of these measures, Planning Condition 14 can be discharged for the hotel development.



Appendix A - Plant and Mitigation Information

19-0010-R3-SCH1: Plant Schedule

19-0010-R3-SCH2: Mitigation Schedule

19-0010-PA1: Plant Area plan showing plant locations and proposed mitigation measures



19-0010-R3-SCH1: Plant Schedule

Unit Reference ⁱ	Unit Model	Location	No. of Units	Measured Data Type ⁱⁱ	Manufacturers Noise Data, dB at Octave band mid-frequency, Hz							
					63	125	250	500	1k	2k	4k	8k
AHU1 I	RW-PPGV42 HPR35	Rooftop	1	L_w	63.0	74.0 ⁱⁱⁱ	67.0	67.0	63.0	61.0	56.0	52.0
AHU1 O	RW-PPGV42 HPR35	Rooftop	1	L_w	68.0	82.0 ⁱⁱⁱ	74.0	77.0	75.0	71.0	65.0	60.0
AHU1 B/O	RW-PPGV42 HPR35	Rooftop	1	L_w	64.0	68.0	52.0	48.0	46.0	40.0	39.0	24.0
AHU2 I	RW-PPGV42 HPR50	Rooftop	1	L_w	63.0	78.0 ⁱⁱⁱ	72.0	76.0	74.0	69.0	64.0	60.0
AHU2 O	RW-PPGV42 HPR50	Rooftop	1	L_w	67.0	79.0 ⁱⁱⁱ	72.0	75.0	73.0	69.0	62.0	57.0
AHU2 B/O	RW-PPGV42 HPR50	Rooftop	1	L_w	60.0	64.0	50.0	47.0	45.0	38.0	38.0	24.0
HRU In/Out	EXI-Tite HRS 05	Rooftop	1	L_w	57.0	58.0	62.0	64.0	64.0	60.0	55.0	51.0
ASHP	Lochinvar LAHP452LT	Rooftop	1	L_w	84.0	80.0	75.0	75.0	67.0	65.0	63.0	60.0
CU1	Daikin REYQ16U	Rooftop	1	L_p @ 1m	67.0	69.0	64.0	62.0	56.0	52.0	52.0	47.0
CU2-17	Daikin REYQ8U	Rooftop	16	L_p @ 1m	63.0	64.0	59.0	55.0	50.0	45.0	44.0	36.0
CU18-19	Daikin RZAG50A	Rooftop	2	L_p @ 1m	66.0	66.0	63.0	63.0	57.5	51.0	46.0	40.0
EF1 O	Helios SB EC 160A	Rooftop	1	L_{wA}	47.0	47.0	50.0	53.0	49.0	51.0	51.0	49.0
EF1 B/O	Helios SB EC 160A	Rooftop	1	L_{wA}	22.0	22.0	23.0	26.0	16.0	15.0	13.0	10.0
MVHR	Not yet selected	Bedroom facade	1 inlet and outlet per room	Combined inlet and outlet ≤20 dB(A) at 5m per unit; there should be no tonal elements present								
Emergency Plant												
GEN1 ^{iv}	FG Wilson P275-5 with Level 2 Enclosure	Rooftop	1	L_p^* @ 1m	80.0 ^v	82.0 ^v	77.0	75.0	69.0	65.0	65.0	60.0

Notes overleaf:



The plant schedule relates to the assessment of atmosphere-side attenuators only. The assessment relies on an acoustic weather louvre around the plant area with a solid screen along the west perimeter as shown in 19-0010-PA1

ⁱ Unit Reference: LN refers to “low-noise” or “Set-back” setting; S = Supply, E = Extract; I = Intake; O = Outlet; B/O = Unit breakout

ⁱⁱ Measured Data Type: L_p @ xm means data supplied by manufacturer as sound pressure level at a given distance, x; L_w means data supplied by manufacturer as un-weighted sound power level; L_{wA} means data supplied by manufacturer as A-weighted sound power level; L_p^* @ xm means data supplied by manufacturer as single figure sound pressure level at a given distance, x. spectrum applied is based on typical for that type of unit;.

ⁱⁱⁱ Tonal character likely apparent in given frequency range, therefore 6 dB penalty applied with reference to BS 4142:2014

^{iv} Emergency plant, not part of standard plant noise assessment, but considered to limit impact during testing

^v Partial tonal character possibly apparent in given frequency range, therefore 4 dB penalty applied with reference to BS 4142:2014



19-0010-R3-SCH2: Mitigation Schedule

Unit	Indicative Attenuator Type	Atmospheric side silencer, Insertion Loss at Octave band mid-frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
AHU1 Intake	50% 600mm	1	2	7	10	11	9	8	7
AHU1 Discharge	45% 600mm	2	4	8	12	13	13	9	8
AHU2 Intake	40% 900mm	4	7	13	19	23	23	16	13
AHU2 Discharge	45% 900mm	2	5	11	17	20	19	12	10
HRU Intake	50% 600mm	1	2	7	10	11	9	8	7
HRU Discharge	50% 600mm	1	2	7	10	11	9	8	7
EF Discharge	50% 600mm	1	2	7	10	11	9	8	7
Rooftop Screen	Solid Element	Solid screen $\geq 15 \text{ kg/m}^2$ as shown in 19-0010-PA1							

Notes

The silencers should achieve at a minimum the octave band insertion losses set out within the table. Attenuator type free area and length are indicative only.

Attenuator type gives percentage free area and length of a rectangular silencer as standard, if circular diameter given along with length in mm (e.g. 900L) or multiple of diameter (e.g. 1D), where based on specific manufacturer the make and type is given.

All attenuators are to be sized to ensure face velocity does not exceed 2 m/s.

Silencer selections should avoid regenerated noise due to high pressure drop, with any such drop limited to no more than 40 Pa. Indicatively, to help with selection, this could be achieved by limiting face velocity at the silencer to no greater than 4 m/s for a 35% free area silencer, with the limit increasing by approximately 0.75 m/s for each increase of 5% free area. True pressure drop and associated risk of regenerated noise should be stated by the supplier for each chosen silencer.

Attenuators have been sized to meet the plant noise limits at the nearest adjacent buildings and, where necessary, achieve reasonable noise levels ($\leq$ NR 55) in public/customer areas.

Others will be responsible for selecting room-side attenuators with suitable insertion losses to achieve suitable indoor NR levels.



Glossary of Terms

decibel: Usually written as decibel or dB, it is a logarithmic scale used for two purposes. One is to make the expression of numerical sound levels more convenient (with a smaller range and fewer digits). The other is to express sound levels in a manner aligned with human interpretation of differences in sound level, which itself is logarithmic in nature.

A-weighting: Applies different weight to sound levels at different frequencies, to represent the variation in sensitivity of the typical human ear with frequency. Thus, a single-value expressed in terms of dBA or dB(A) is the A-weighted sound level, which takes account of the frequency content of the sound.

L_{Aeq} : The A-weighted equivalent continuous sound level in dB. This unit can be described as the notional steady noise level that would, over a period, contain the same energy as the fluctuating noise source. It is often considered as the energy average level. This unit is typically used to describe typical day and night time noise levels.

L_{A90} : The A-weighted sound level (in dB) exceeded for 90% of the time specified. This level gives an indication of the sound level during the quieter periods of time in any given fluctuating sound sample. It is used to describe the "background sound level" of an area.

L_{A10} : The A-weighted sound level (in dB) exceeded for 10% of the time specified. This level gives an indication of the sound level during the louder periods of time in any given fluctuating sound sample. It is typically used to help define, measure, and assess road traffic noise.

L_{Amax} : The maximum A-weighted level (in dB) of sound measured in any given period. This unit is used to measure and assess transient noises, particularly those such as individual vehicles, etc impacting on sensitive receptors at night. Unless otherwise stated, the L_{Amax} level is stated as measured using a "fast" sound level meter response (i.e. $L_{Amax, F}$).

L_{AX} , L_{AE} , or SEL: The sound exposure level which contains, within a notional 1-second period, the same quantity of sound energy as the time varying level contained in a single noise event. It could be considered an L_{Aeq} level normalised to 1 second. The use of this unit allows the calculation of the $L_{Aeq, T}$ level over a given period of time for a known number of such single noise events.