SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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40-46 Princess Street, Manchester

Plant noise egress testing (planning condition 6)

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Summary

Sandy Brown has been commissioned by Wittington Investments (Properties) Ltd to provide acoustic advice in relation to the proposed development at 40-46 Princess Street, Manchester.

Plant noise egress limits have been set based on the requirements of Manchester City Council, and on the results of the noise survey carried out by Sandy Brown.

Details of the environmental noise survey and previous noise egress assessment are provided in Sandy Brown report *17132-R01-E Acoustic planning report*, dated 9 April 2021.

This report presents the survey method and results of attended plant measurements of installed and operational plant at rooftop level, and basement level with atmosphere side connections at ground level which were carried out on 8 November 2023.

This report sets out relevant information to discharge Planning Condition 6 (135200/JO/2022) which relates to external plant noise egress.

Based on the measurement results, plant noise egress associated with the installed and operational plant is expected to meet with relevant noise criteria during the day and during the evening.

During the night, the predicted levels are below the limits at all noise sensitive premises except at 105-107 Portland Street, in which the limit is exceeded by up to 4 dB. As such, some plant items will need to be switched off during the night to allow the criteria to be met.

The installed rooftop plant design and selections differ from those assessed previously. Not all plant was operational at the time of the visit. As such further measurements of the other plant installed will need to be carried out in due course to demonstrate compliance with Planning Condition 6.

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1 Introduction

Sandy Brown has been commissioned by Wittington Investments (Properties) Ltd to provide acoustic advice in relation to the proposed development at 40-46 Princess Street, Manchester.

Details of the environmental noise survey carried out on April and May 2017 and previous noise egress assessment are provided in Sandy Brown report *17132-R01-E Acoustic planning report*, dated 9 April 2021.

Based on the results of the noise survey and the requirements of Manchester City Council, cumulative noise egress limits were set out and apply to all plant in operation under normal conditions.

This report presents the survey method and results of attended plant measurements of installed and operational plant at rooftop level, and basement level with atmosphere side connections at ground level, and carried out on 8 November 2023.

This report also presents a noise egress assessment of the rooftop plant servicing level 8 to level 10, and atmosphere side connections at ground level for the AHU and HRU installed at basement level. Further measurements of the other plant will need to be carried out in due course once operational to demonstrate compliance with Planning Condition 6.

2 Site description

The development at 40-46 Princess Street, Manchester includes a leisure /gym unit at basement level, speculative offices on the ground and upper floors, and a new rooftop plant area.

2.1 The site and its surrounding

The site location in relation to its surroundings is outlined in yellow in Figure 1.

The site is bounded by Princess Street north to east, a courtyard and office building to the north-west, 2 Harter Street to the southwest and Harter Street to the south.

Figure 1 Aerial view of site (courtesy of Google Earth Pro)

2.2 Adjacent premises

The site location in relation to its surroundings is outlined in yellow in Figure 1. The site is located in a mixed use area, with the immediate surrounding comprising of residential accommodation, hotel, office, retail units (including restaurants).

The site is in a mixed-use area. The following existing residential apartments are located within close proximity to the site:

- 48-50 Princess Street, 8 m to the south. This is highlighted in red in Figure 1.
- 2 Harter Street, adjacent to the site to the south. This is highlighted in blue in Figure 1.
- Level 1 to Level 4 of 105 to 107 Portland Street, approximately 5 m to the north-west highlighted in dark green in Figure 1.
- 103 Portland Street, approximately 5 m to the north-west, highlighted in light green in Figure 1.

There is hotel accommodation (Townhouse Hotel) located approximately 15 m to the north-east, this is also considered noise sensitive and highlighted in light blue in Figure 1.

The nearest commercial premises considered to be noise sensitive during the daytime are the rear facade of 109 and 113 Portland Street to the north and west respectively. These are highlighted in purple and brown respectively in Figure 1.

Other noise sensitive premises include 101 and 103 Princess Street approximately 15 m and 25 m respectively to the east. These are highlighted in pink and orange respectively in Figure 1.

2.3 Plant noise sources

The development includes the following 15no external heat recovery units at rooftop level, and installed left to right with reference to Figure 2 as follows:

- Level 7, 2 x PURY-P350YNW-A1
- Level 3, 2 x PURY-P350YNW-A1
- Level 5, 1 x PURY-P350YNW-A1
- Level 9, 1 x PURY-P550YNW-A1
- Level 10, 1 x PURY-P300YNW-A1
- Level 6, 1 x PURY-P350YNW-A1
- Level 8, 1 x PURY-P250YNW-A1
- Level 8, 1 x PURY-P200YNW-A1
- Level 4, 1 x PURY-P400YNW-A1
- Level 2, 1 x PURY-P400YNW-A1
- Level 1, 1 x PURY-P550YNW-A1
- Level 1, 1 x PURY-P500YNW-A1
- Level 0, 1 x PURY-P350YNW-A1

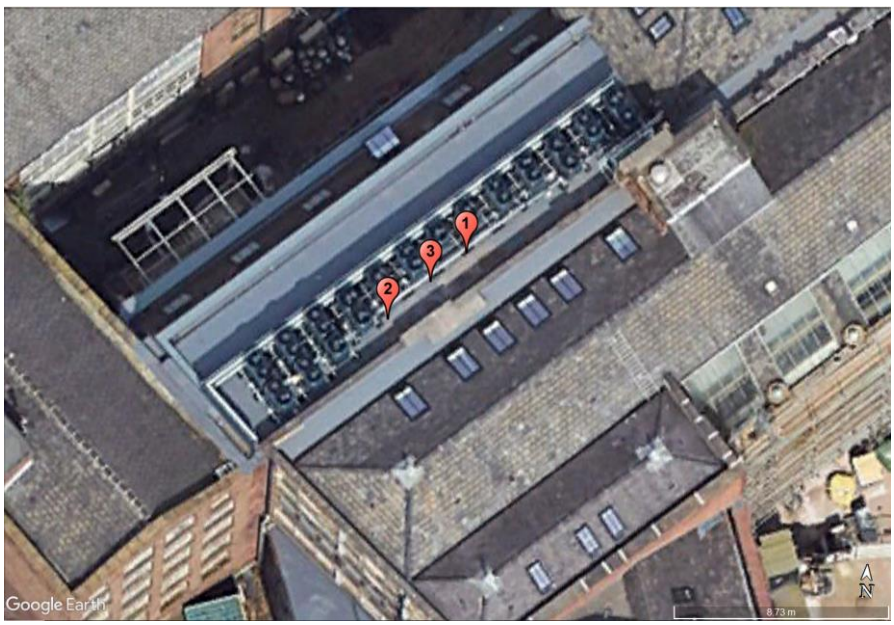

Figure 2 Installed plant and measurement positions at rooftop level (image courtesy of Google Earth)

At basement level, the installed plant items with atmosphere side connections with reference to Figure 3 as follows:

- 1 x AHU (intake and exhaust)
- 1x HRU (intake and exhaust)

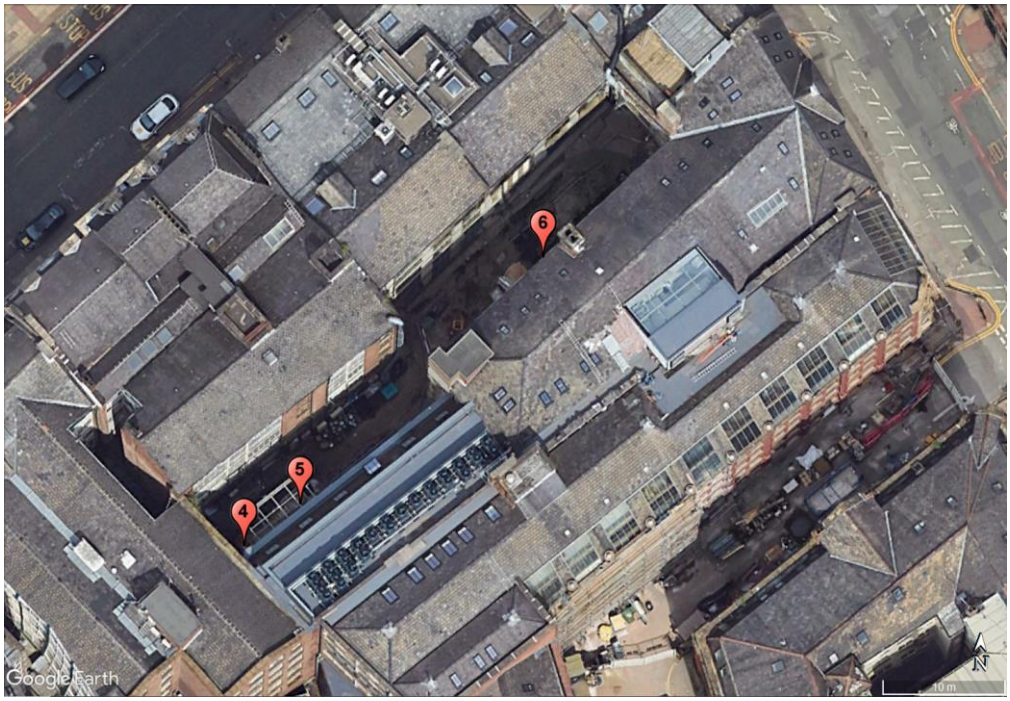

Figure 3 Installed plant and Measurement positions at ground level (image courtesy of Google Earth)

Photographs of measurement positions 4, 5 and 6 are provided in Figure 4.

Figure 4 Measurement positions at ground level (pos 4 left, pos 5 middle, pos 6 right)

3 Building services noise egress criteria

3.1 Standard guidance

BS 4142:2014:+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at nearby noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

3.2 Local Authority criteria

3.2.1 Planning condition 6 (135200/JO/2022)

Planning condition 6 states the following:

> *a) Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with the acoustic report reference 17132-R01-E received by the City Council as local planning authority on 19 April 2022. The scheme as detailed within this approved document shall be implemented in full before the use commences.*
>
> *b) Within 3 months of the first operation of the scheme, 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 conforms to the recommendations and requirements approved as part of part (a) of this planning condition. The verification report shall include post completion testing to confirm the noise criteria has been met. In instances of non-conformity, these shall be detailed along with mitigation measures required to ensure compliance with the noise criteria. A verification report and measures shall be agreed until such a time as the development complies with part (a) of this planning condition.*
>
> *Any mitigation measures shall be implemented in accordance with a timescale to be agreed with the City Council, as Local Planning Authority. Any measures shall thereafter retained and maintained in situ.*

4 Plant noise measurements

4.1 Method

Attended sample measurements were carried out on 8 November 2023. All measurements were carried out in 1/3 octave bands.

An MEP engineer was present during the visit to operate and set the items of plant at the designed duty and confirming plant operation for each measurement.

At rooftop level, measurements of the installed four outdoor units servicing level 8, 9 and 10 were carried out. The microphone was mounted on a tripod approximately 1.5 m above the rooftop level and approximately 1 m from each plant item in operation.

Measurements were carried out for the plant items servicing each floor in isolation at 80-85% duty (day operation) and 50-55% duty (evening and night operation).

Background noise levels with plant switched off were carried out at the same measurement locations.

Measurement positions at rooftop level are indicated as position 1 to 3 in Figure 2. Measurement positions at ground level are indicated as positions 4 to 6 in Figure 3.

At ground level, measurements of the AHU (intake and exhaust) and HRU (intake + exhaust) atmosphere side connections were carried out. The microphone was mounted on a tripod approximately 1.5 m above the ground level and approximately 1 m from each plant atmosphere termination in operation.

The atmosphere terminations for the HRU were very closed together and measurements were carried out at only one position (position 6).

4.2 Weather conditions

Weather conditions during the survey are described in Appendix A.

4.3 Measurement results

4.3.1 Observations

At rooftop level, the dominant noise sources were plant in operation, with no significant contributions from other environmental sources.

At ground level, the dominant sources at positions 4 and 5 were AHU plant in operation with contributions from existing plant in operation, with no significant contributions from other environmental sources.

For measurement position 6, the dominant source were equal contributions from plant in operation and existing plant in operation installed in the courtyard.

4.3.2 Noise measurement results (plant in operation)

Noise levels and sources recorded during the attended sample measurements are summarised in Table 1. The measurement positions relate to Figure 2 and Figure 3.

Table 1 Noise levels and sources from attended plant measurements

Position	Start time	Sound pressure level, $L_{Aeq,1min}$ (dB)	Noise sources
1	17:17	67	Level 8, PURY-P200YNW-A1 +PURY-P250YNW-A1
	17:19	67	
	17:19	67	Dominated by plant in operation at 80% duty
	17:46	59	Level 8, PURY-P200YNW-A1 +PURY-P250YNW-A1
	17:48	60	
	17:49	60	Dominated by plant in operation at 50% duty
2	18:33	72	Level 9, PURY-P550YNW-A1
	18:35	72	Dominated by plant in operation at 85% duty
	18:36	72	
	18:57	66	Level 9, PURY-P550YNW-A1
	18:58	66	Dominated by plant in operation at 55% duty
3	19:23	71	Level 10, PURY-P300YNW-A1
	19:24	70	Dominated by plant in operation at 85% duty
	19:25	70	
	19:36	57	Level 10, PURY-P300YNW-A1
	19:37	60	Dominated by plant in operation at 50% duty
	19:38	60	
4	20:12	67	Dominated by AHU exhaust atmosphere termination
	20:13	67	
	20:14	67	
5	20:16	60	Dominated by AHU intake atmosphere termination
	20:18	59	

Position	Start time	Sound pressure level, $L_{Aeq,1min}$ (dB)	Noise sources
	20:20	60	
6	20:40	61	Dominated by HRU intake+ exhaust atmosphere terminations with contributions from existing plant in operation in the courtyard
	20:42	61	
	20:43	61	

4.3.3 Noise measurement results (background)

Background measurements were carried out to account for environmental sources at the measurement positions, the plant items from the development were switched off.

Measurements were carried out such that environmental background noise levels were the dominant source.

Noise levels and sources recorded during the attended sample measurements are summarised in Table 2.

Table 2 Background measurement results

Position	Start time	Sound pressure level, $L_{Aeq,1min}$ (dB)	Noise sources
1	17:55	53	Plant switched off, dominated by distant road traffic and distant plant in operation from nearby buildings
	17:57	53	
2	18:25	53	Plant switched off, dominated by distant road traffic and distant plant in operation from nearby buildings
3	18:38	51	Plant switched off, dominated by distant road traffic and distant plant in operation from nearby buildings
4	20:26	58	Plant switched off, dominated by existing plant in operation in the courtyard
	20:27	58	
5	20:32	60	Plant switched off, dominated by existing plant in operation in the courtyard
	20:33	60	

5 Plant noise limits

Based on the measurement results from environmental noise surveys previously carried out at the site, as presented in Sandy Brown report *17132-R01-E Acoustic planning report,* the cumulative plant noise egress limits are presented in Table 3. These apply outside the nearby noise sensitive receptors.

Table 3 Plant noise limits at 1 m from the nearest noise sensitive premises

Location	Time of day	Maximum sound pressure level at 1 m from noise sensitive premises (L_{Aeq} dB)
South	Daytime (07:00-19:00)	53
48-50 Princess St,	Evening (19:00-23:00)	51
2 Harter Street	Night-time (23:00-07:00)	52
North-east	Daytime (07:00-19:00)	55
Townhouse Hotel	Evening (19:00-23:00)	55
	Night-time (23:00-07:00)	54
North	Daytime (07:00-19:00)	61
103,105-107,	Evening (19:00-23:00)	57
109-113 Portland Street (Courtyard)	Night-time (23:00-07:00)	42 (103, 105-107 Portland Street only)

The limits set out in Table 3 do not include any attention catching features. The penalties for attention catching features may be significant, and will need to be considered within the assessment. This is discussed further in Appendix B.

6 Plant noise egress assessment

6.1 Plant noise levels

The average measured plant noise levels for each item of plant in operation are summarised in Table 4. The measurement results have been derived from the measured one-third octave band measurements results and are not background corrected.

Table 4 Average plant noise levels measured at 1m

Plant item	Sound pressure levels, L_{eq} at 1 m (dB) Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Level 8 PURY-P200YNW-A1 + PURYP250YNW-A1 (80% duty)	69	67	66	65	60	57	56	49
Level 8 PURY-P200YNW-A1 + PURYP250YNW-A1 (50% duty)	65	71	58	57	53	49	46	40
Level 9 PURY-P550YNW-A1 (85 % duty)	63	68	71	65	61	65	58	53
Level 9 PURY-P550YNW-A1 (50 % duty)	63	61	63	54	49	50	45	44
Level 10 PURY-P300YNW-A1 (85 % duty)	78	73	73	70	66	61	57	50
Level 10 PURY-P300YNW-A1 (55 % duty)	74	63	67	63	60	55	51	45
Ground floor termination AHU intake	62	62	59	58	55	50	44	35
Ground floor termination AHU exhaust	63	74	60	63	62	61	55	46
Ground floor termination HRU intake + exhaust	61	59	62	60	56	50	44	38

6.2 Noise egress assessment

The predicted noise rating levels at the nearest noise sensitive premises take in the account the following:

- Plant measurement results, and background correction where applicable
- Attenuation due to distance, screening and directionality
- AHUs and AHU in operation during the day and evening
- Rooftop plant at 80-85% duty during the day, 50-55% duty during the evening and night
- 3 dB correction for facade reflection at the nearest noise sensitive premises

6.2.1 Predicted noise levels

The predicted noise levels for the operation of the measured plant in operation, at the nearest noise sensitive premises are summarised in Table 5.

The predicted noise levels do not include corrections for acoustic catching features as none were noted during the measurements.

Table 5Predicted noise egress levels from measured plant in operation (rooftop and ground level)

Location	Predicted sound pressure level from installed and operating plant, 1 m from noise sensitive premises, L_{Aeq} (dB)		
	Day (07:00 - 19:00)	Evening (19:00 - 23:00)	Night (19:00 - 23:00)
109 to 113 Portland Street (courtyard)	57	51	49
105-107 Portland Street-First floor level (courtyard)	53	49	44
105-107 Portland Street-Level 4 (courtyard)	54	48	46
103 Portland Street-First floor level (courtyard)	40	39	15
103 Portland Street-top floor level (courtyard)	39	38	15
48 -50 Princess Street	34	27	27
2 Harter Street	38	31	31
Townhouse Hotel (level 6 windows)	32	25	25

The predicted cumulative levels from the installed plant meet with the required criteria with the exception of 105-107 Portland Street, which exceeds the limit by 4 dB at night.

6.2.2 Mitigation required

At this stage, some of the rooftop units will need to be switched off during the night (2300-0700 hrs) to ensure that the requirements of Planning Condition 6 are met. Based on the measurements and assessment, unit PURY-P300YNW-A1 which serves level 10 should be switched off during this period. Units PURY-P200YNW-A1 + PURYP250YNW-A1 and PURY-P550YNW-A1 which serve levels 8 and 9 are able to run at a reduced duty of 50% during the night, whilst being compliant with Planning Condition 6.

6.2.3 Further plant items

Contributions from other plant items are expected to increase the levels at the nearest noise sensitive premises. Further measurements and/or assessment is required one all plant is fully operational to ensure that the cumulative noise egress levels meet with the requirements of Planning Condition 6.

7 Conclusion

Measurements of installed and operational plant items serving level 8, 9 and 10 office spaces were carried out at the site. Measurements of AHU and HRU atmosphere terminations were also carried out at ground level.

The measured plant noise levels have been assessed to the nearest noise sensitive premises. The criteria are met with the exception of 105-107 Portland Street at night, where the limit is exceeded by 4 dB. Some of the rooftop plant units will therefore need to be switched off during the night to ensure that the requirements Planning Condition 6 are met.

Other plant items are also installed, which these were not commissioned or operational at the time of the visit. Further measurements and assessment will be required in due course to satisfy the requirements Planning Condition 6.

Appendix A

Survey details

Equipment

The attended noise measurements were taken using a NL-52 sound level meter.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/01143564	Rion	15 Dec 24	TCRT22/1766
Microphone	UC-59/10153	Rion	15 Dec 24	TCRT22/1766
Pre-amp	NH-25/43581	Rion	15 Dec 24	TCRT22/1766
Calibrator	NC-74/34257023	Rion	15 Dec 24	TCRT22/1765

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meter used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg, L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS 7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

During the attended noise measurements, the weather was generally clear and dry and no rain occurred. Wind speeds were measured at each position and varied between 0 m/s and 2 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.