ROYAL COLLEGE OF OPHTHALMOLOGISTS

PLANT NOISE ASSESSMENT

Acoustics Report A580/R01a
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1 Introduction

Ion Acoustics is appointed by the Royal College of Ophthalmologists to advise them and the design team on external plant noise issues relating to the proposed development of 18 Stephenson Way in Camden. The building is being redeveloped to form office and laboratory facilities for the organisation and the development will include the construction of a new roof extension and provision of new external building services plant.

This assessment has been carried out to determine a noise limit for the new plant relative to the measured background noise level and assess the plant proposals for submission to London Borough of Camden with the planning application. To set noise limits, Ion Acoustics has carried out a baseline noise survey to determine the background noise level at the site. Details of the proposed plant have been provided by E3 Consulting Engineers and calculations made to determine the noise levels and demonstrate compliance with appropriate noise limits.

2 Noise Limits and Criteria

The Camden planning officer has advised the team that an assessment of the plant noise impact will be required. Ion Acoustics has spoken with the planning officer and with the environmental health officer to discuss the scheme.

2.1 Likely Planning Noise Limit

The Camden noise criteria are documented in their guidance DP28, a copy of which has been provided by the environmental health officer.

This advises that the standard Camden plant noise limit is for the aggregate of plant noise to be 5dB(A) below the background noise level outside a sensitive facade windows. If however the plant noise is considered to have a tonal characteristic, then it would need to be 10 dB(A) below the underlying background noise limit. The environmental health officer advised that "sensitive" uses in this case includes residential and office accommodation.

DP28 also has a further absolute noise limit which states that where the background noise level exceeds LA90 60 dB (as is the case here) then a limit of L_{Aeq} 55 dB applies outside the windows.

We have no information to suggest that the proposed plant will have prominent tones and in this case the plant noise limit is taken as 5dB below the existing noise levels. Furthermore, it is good practice to ensure that in any case the new plant noise does not exceed L_{Aeq} 55 dB outside other commercial windows (or residential windows) in any case, regardless of the background noise level.

3 The Building and Surroundings

3.1 The Site

The location of the building is shown in Figure 1 below. The building is located close to Euston station with its frontage at 18 Stephenson Way and a rear façade overlooking Regnart Buildings (a narrow dead end street). Neither is heavily trafficked and road traffic noise is not significant

from either street. However, the Euston Road is located one block to the south and would have a significant effect on the underlying background noise levels in the absence of other local plant noise sources.

The adjacent buildings to No. 18 Stephenson Way are commercial office buildings. The nearest building with residential accommodation is the MIC conference centre to the north with its rear façade overlooking Regnart Buildings. This has residential accommodation on upper floors, thought to comprise hotel type accommodation possibly with staff accommodation on the upper mansard floor. The facade is 8m to the north of the roof parapet of 18 Stephenson Way.

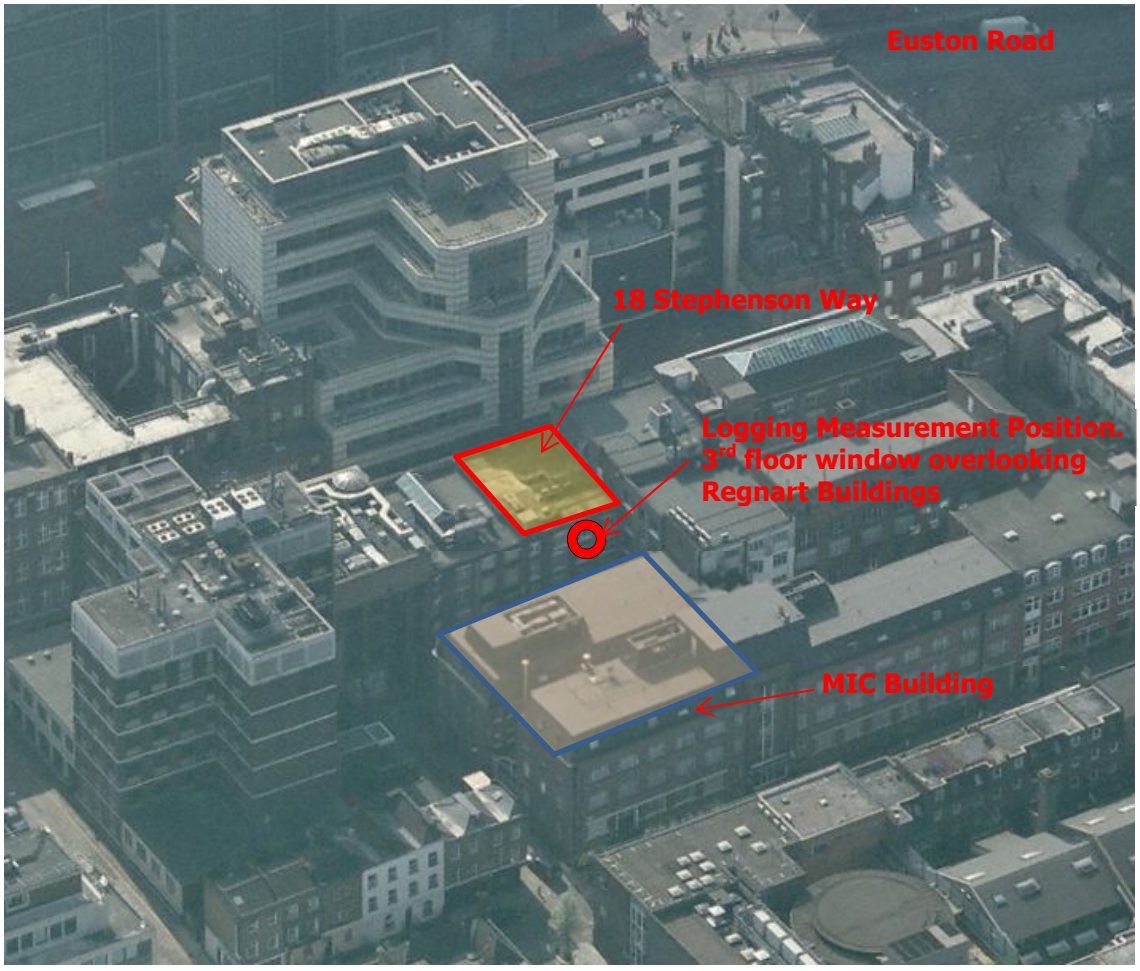


Figure 1: Site location showing noise survey measurement position (image from Bing.com)

3.2 Existing Off Site Noise Sources

Ion Acoustics have visited the site to make noise measurements and to make observations of key noise sources affecting the building and those surrounding it. The area is affected by high levels of existing plant noise. In particular, the dominant noise source is from building services plant in a louvred enclosure on the roof of the MIC building to the north. The closest louvre was 13.5m from the northern façade of 18 Stephenson Way. The noise from this louvre has a tonal character and from the 24 hour measurements has been found to be continuous

throughout the full night. There is also some plant noise from condenser units on the adjacent building (at 1.5m from the parapet of the party wall) which, whilst much closer, are quieter than the MIC roof plant.

There is also some fixed plant on the office building to the south (between Stephenson Way and Euston Road). This is expected to control the background noise levels on the lower southern façade facing Stephenson Way.

During the site visits there was construction work on buildings to the east along Stephenson Way which meant the road was not accessible as a through route, so there was little road traffic. It is however unlikely that even if this was open that there would sufficient traffic to affect the background noise levels.

The noise levels on the roof and affecting the nearby MIC are entirely dominated by the MIC plant noise. However, in the absence of that it is expected that the underlying background noise levels would be controlled by a combination of other plant and road noise from the busy Euston Road. The site would therefore never be particularly quiet, even at night.

It is noted that future developments will include the HS2 link to the east (near Euston Station) which may have some impact on noise levels at the site. However, this would only be expected to increase noise if there were any change in level.

3.3 Existing Plant on 18 Stephenson Way

The building has eight external condenser units located on the roof currently. These have now been disconnected as part of the building strip out works, but are part of the lawful use of the site currently. The noise from these could therefore not be measured, but they would have generated some noise affecting the adjacent buildings.

There is additionally a liftshaft extract fan, but again this is not currently operational and could not be measured.

3.4 Proposed Plant Scheme

The proposed plant scheme has been developed by E3. This is a draft scheme at this stage prior to planning, but represents what is likely to be installed. It is not yet possible to definitively state what equipment will be installed as the scheme has not yet been finalised and tendered. However, indicative selections of the plant have been made as listed below:

- AHU (Swegon Gold RX Size 12)
- 3 x external condenser units (2 x Daikin RYMQ18 and 1 x Daikin RYMQ16)
- Laboratory exhaust fan (Systemair KVO 250)
- Toilet extract fan (Systemair KVK Duo 250)

The final scheme will be similar and will be selected to meet the same noise limits as the scheme discussed herein. The roof plan and plant locations are shown in Figure 2.

There is additionally a new Swegon AHU unit to be located internally at basement level and ducted to the rear at Regnart Buildings with attenuators in the ducting Noise levels from this unit have been calculated along with the roof plant.

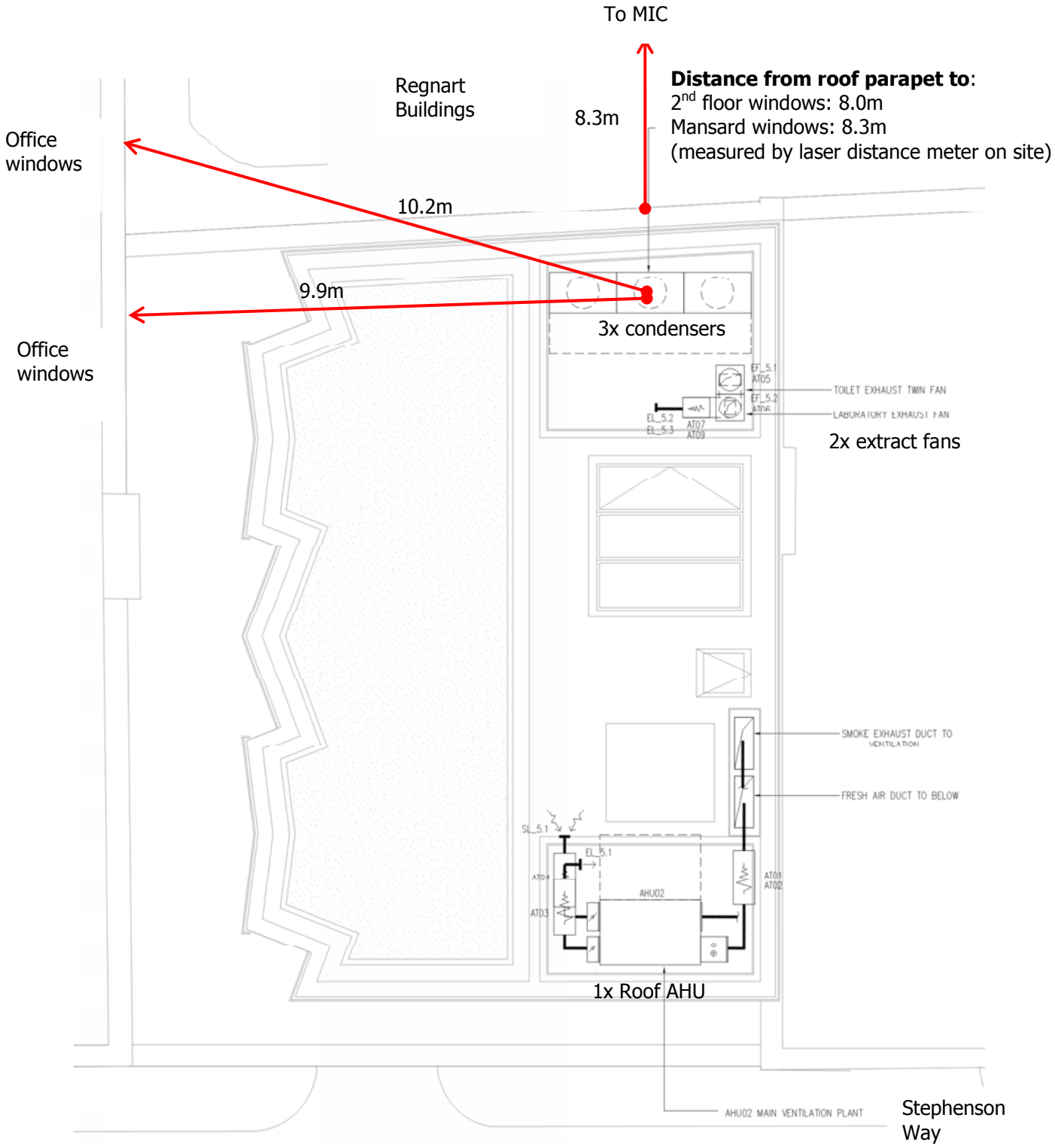


Figure 2: Roof plant location (showing distance to nearest residential windows)

4 Background Noise Levels

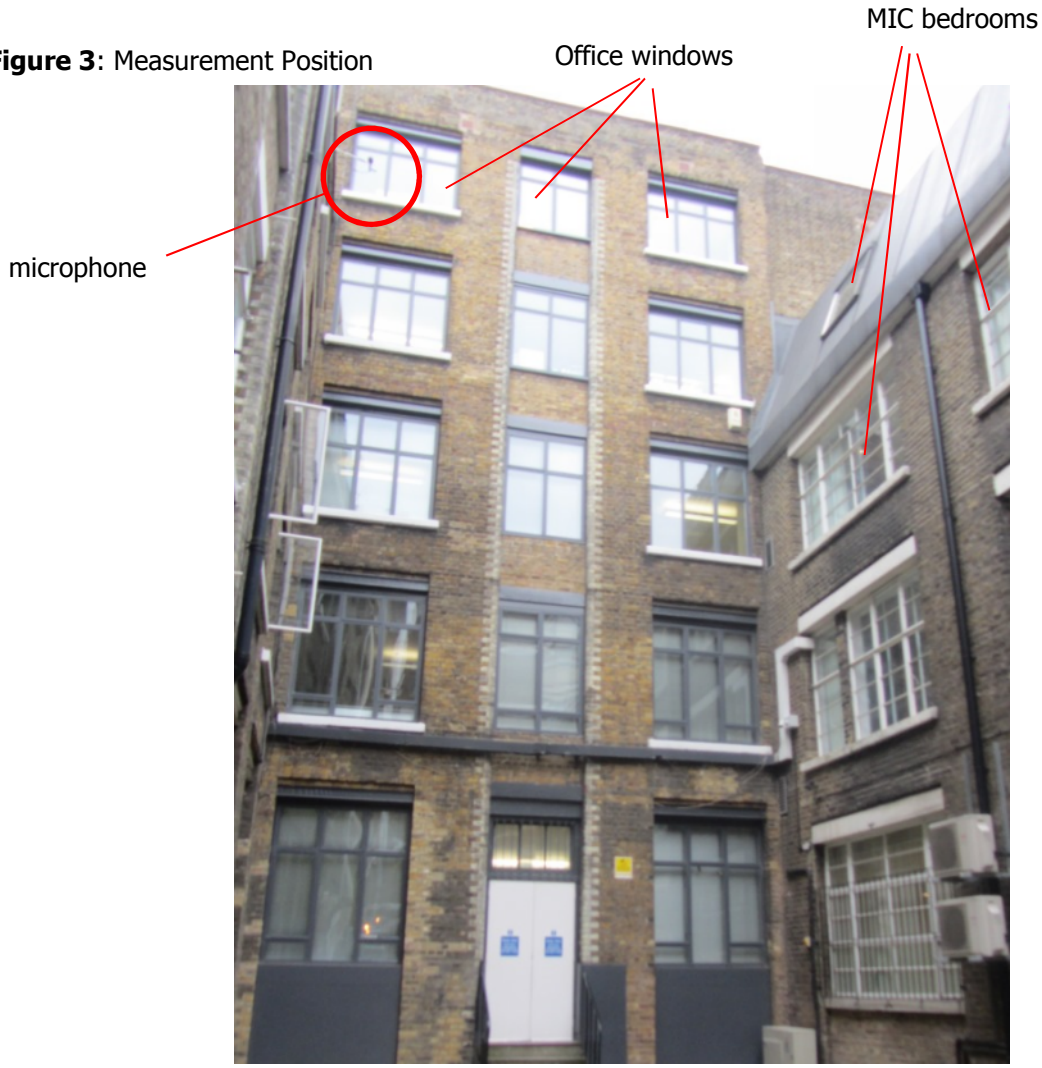
4.1 Survey Procedure

A noise survey was carried out over the period 21st to 22nd February 2013. A noise monitor was set up on the site to run (unattended) over a period of 23 hours to ensure it included the quietest periods of the day evening and night. In addition some attended measurements were made around the site.

The noise monitor was set up with the microphone mounted on a pole 1m out of the rear 3rd floor windows of 18 Stephenson Way overlooking the MIC building to the north and the street called Regnart Buildings. This was immediately opposite the residential windows on the MIC and about 5m from the office windows. The position is shown in the photograph in Figure 3.

A Norsonic Nor 140 sound level analyser was used for the survey and set up to log noise levels in consecutive 10 minute periods. The meter was calibrated with a Brüel & Kjær Type 4231 sound level calibrator. No change in the calibration level was noted over the measurement period. Additional attended measurements were made on the roof and at ground level in Regnart Buildings.

Figure 3: Measurement Position



4.2 Noise Levels

The noise levels measured at the logging position are shown in Figure 4 below.

During setup of the noise monitor, noise levels externally at the rear, on the roof and at ground level in Regnart Buildings were dominated by the building services plant on the roof of the MIC building. This generated at level of L_{A90} 68 dB at position 1 (logging monitor location). The plant noise levels were remarkably consistent with the L_{A90} varying by less than 1dB(A) over the entire day, evening and night period. The difference between the L_{A90} (the level exceeded for 90% of the time and defined as the background level) and L_{Aeq} (ambient level accounting for all the sound energy) is less than 1dB for any 10 minute period.

The full noise levels measured are given in Appendix A.

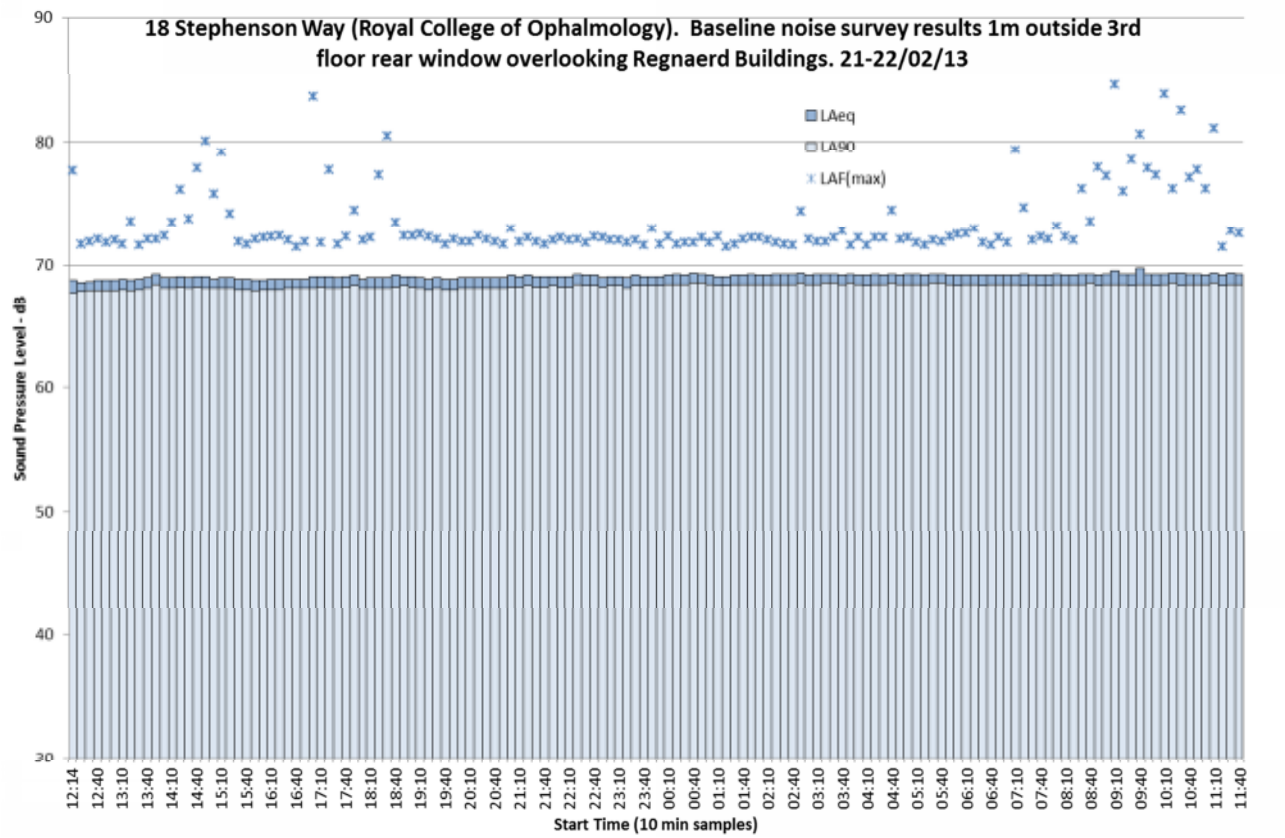


Figure 4: Noise Levels Measured at rear of 18 Stephenson Way

Figure 4 shows noise levels which are dominated by steady plant noise throughout the day and night. The lowest background noise level was L_{A90} 68 dB (67.8).

4.3 Attended Measurements

The measurement position had a direct line of sight to the plant on the MIC. However MIC is considered to be the nearest sensitive receptor and these windows would not have a line of

sight to the louvre (although they would receive direct reflections from the rear of the Stephenson Way buildings). Therefore additional measurements were made on the ground level of Regnart Buildings close to the rear façade of the MIC building to determine a transfer function between the logging measurement positions and the rear residential windows.

At 1m outside the rear façade of Regnart Building the noise was dominated still by the roof plant noise from the MIC, despite there being no direct line of sight. The sound was being reflected off the buildings and there is a canyon effect from multiple reflections between the buildings which reduces the shielding . We measured MIC plant noise levels of L_{Aeq} 65 dB, L_{A90} 64 dB, at this position only 4dB lower than at the logging position. There are condenser units at ground level in Regnart Place, but none were operating during these measurements. The existing noise levels at the second floor windows of the MIC are therefore likely to be somewhere between the two (as they are closer to the plant) at around L_{A90} 66 dB. This value is taken as the typical underlying background noise level outside the windows at the rear of the MIC, the closest residential windows and is used to set noise limits for the new plant at the nearest residences. The measurements at the logging position represent the background noise at the offices (L_{A90} 68 dB).

A short attended measurement was also made out of the 3rd floor south window (shielded from the MIC plant) which still gave L_{A90} 62 dB; this would represent the offices to the south.

4.4 Plant Noise Limits

A planning plant noise limit of 5dB(A) below the background noise level is likely to apply. On this basis the following limits would apply:

MIC Bedrooms:	Background L_{A90} 66 dB, Plant Limit 61 dB(A)
Upper Floor Adjacent Offices:	Background L_{A90} 68 dB, Plant Limit 63 dB(A)

The limits are based on the assumption that the plant noise does not have tonal characteristics. Fan noise is generally broadband in character. However in addition it would be expected that noise levels outside any window (commercial or residential) do not exceed 55 dB(A). This is equivalent to a limit over 10 dB below the existing background noise levels.

5 Plant Calculations

The noise levels from the proposed scheme have been calculated to the closest receptors including offices. The worst affected are the upper floor windows of the MIC and the most affected office windows in the 22 Stephenson Way, the building to the west of 18 Stephenson Way (Figure 2 and 3). A calculation to the worst case receptor is given in Appendix A. The MIC windows have a direct line of sight to the condenser units and a partial line of sight to the rooftop AHU. The office windows are partially shielded from the condensers by the new roof extension and fully shielded for the AHUs and extract fans.

The distances assumed are shown in the calculations which are attached in Appendix A. The distance of the closest windows to the roof edge was measured on site using a Leica Disto laser

distance measurement. The distance of the plant from the roof edge is taken from the E3 drawings.

5.1 To MIC bedroom windows

The calculations, attached in Appendix A, indicate a free field noise level of 52 dB(A) outside the residential windows of the MIC. This meets the LAeq 55 dB fixed limit and is 13 dB(A) below the lowest background noise level at the windows (66 dB(A)) and therefore it is unlikely that any of the 18 Stephenson Way plant will be audible. It is noted that the MIC hotel rooms have secondary glazing which will significantly reduce internal noise levels. The bedrooms are described on the MIC website as having climate control, and so they are also likely to be mechanically ventilated avoiding the need to open windows. The new plant will operate during the daytime only; this is not particularly relevant to the noise limit as the background noise is consistent during the full 24 hours, but it is relevant that the nearest receptors are bedrooms and for much of their key use period (night) there will be no noise from the new 18 Stephenson Way plant in any case.

5.2 To Office Windows

The predicted noise level, with slightly better shielding from the condenser units, is 50 dB(A). This meets the LAeq 55 dB fixed limit and is 18 dB(A) below the background noise level and is again, not expected to be audible inside the offices.

5.3 Assumptions

The following minimum assumptions have been made in the calculations, it may be that additional treatments are provided to reduce levels to the new roof extension:

- Attenuators are provided on atmosphere side of the AHU (Fresh Air Intake and Extract Discharge)
    - 600mm long for the roof
    - 900mm long for the basement
    - The insertion losses assumed are given in the calculations, but different attenuators could also be used to achieve noise limits given
- An attenuator will be provided on the atmosphere side of the laboratory extract fan, again this is assumed at 600mm with the insertion loss stated in the report
- The condenser units have a direct line of sight to the MIC receptors, but are installed with the discharge vertically.

In summary then, the proposed plant scheme can comfortably meet the standard Camden planning limit of 5dB(A) below the background noise. Furthermore, the levels will be around 13dB(A) below the background noise levels outside the housing and will be below 55 dB(A). They will be even further below the background noise levels at the offices. They are unlikely to be audible at either receptor.

Therefore, the proposed scheme will be acceptable in respect of maintaining residential amenity to the nearby MIC building and to offices. Other residences are a significant distance away and will not be affected by the new plant noise.

6 Summary

A noise assessment of proposed new plant for a refurbishment of 18 Stephenson Way has been carried out to demonstrate that appropriate noise conditions can be met for compliance with London Borough of Camden's likely planning conditions. A baseline noise survey has been carried out to determine existing background noise levels at the rear. Noise predictions have been prepared to demonstrate that the plant noise levels will be substantially below the background noise levels and will comply with the standard Camden plant noise criteria for the nearest residential locations and for office users.

18 Stephenson Way - Measured Noise Levels at Rear

time	$L_{AF(max)}$	L_{Aeq}	L_{A90}	time	$L_{AF(max)}$	L_{Aeq}	L_{A90}	time	$L_{AF(max)}$	L_{Aeq}	L_{A90}
	dB	dB	dB		dB	dB	dB		dB	dB	dB
12:14	77.6	68.8	67.8	21:00	73.0	69.2	68.3	06:00	72.5	69.2	68.4
12:20	71.7	68.6	67.9	21:10	71.9	69.1	68.3	06:10	72.6	69.2	68.5
12:30	71.9	68.7	68.0	21:20	72.2	69.2	68.4	06:20	73.0	69.2	68.5
12:40	72.1	68.8	68.0	21:30	71.9	69.1	68.3	06:30	71.8	69.2	68.4
12:50	71.8	68.8	68.0	21:40	71.7	69.1	68.3	06:40	71.6	69.2	68.5
13:00	72.0	68.8	68.0	21:50	72.0	69.1	68.4	06:50	72.2	69.2	68.5
13:10	71.7	68.9	68.1	22:00	72.2	69.1	68.3	07:00	71.8	69.2	68.5
13:20	73.6	68.8	68.0	22:10	72.0	69.1	68.3	07:10	79.3	69.2	68.5
13:30	71.6	68.9	68.1	22:20	72.1	69.3	68.5	07:20	74.7	69.3	68.4
13:40	72.1	69.0	68.2	22:30	71.8	69.2	68.4	07:30	72.0	69.2	68.5
13:50	72.1	69.3	68.5	22:40	72.3	69.2	68.4	07:40	72.3	69.2	68.4
14:00	72.4	69.0	68.2	22:50	72.2	69.0	68.3	07:50	72.1	69.2	68.4
14:10	73.5	69.0	68.2	23:00	72.0	69.1	68.4	08:00	73.2	69.3	68.5
14:20	76.1	69.1	68.3	23:10	72.0	69.1	68.4	08:10	72.3	69.2	68.5
14:30	73.8	69.0	68.2	23:20	71.8	69.0	68.2	08:20	72.0	69.2	68.5
14:40	77.8	69.1	68.3	23:30	72.0	69.2	68.4	08:30	76.2	69.3	68.5
14:50	80.1	69.1	68.2	23:40	71.6	69.1	68.4	08:40	73.6	69.3	68.6
15:00	75.8	68.9	68.2	23:50	73.0	69.1	68.4	08:50	77.9	69.2	68.4
15:10	79.1	69.0	68.2	00:00	71.7	69.1	68.4	09:00	77.2	69.3	68.5
15:20	74.2	69.0	68.2	00:10	72.3	69.2	68.5	09:10	84.6	69.6	68.5
15:30	71.9	68.9	68.1	00:20	71.7	69.3	68.5	09:20	76.0	69.3	68.5
15:40	71.7	68.9	68.1	00:30	71.8	69.2	68.5	09:30	78.5	69.3	68.4
15:50	72.1	68.8	68.0	00:40	71.8	69.4	68.6	09:40	80.6	69.8	68.5
16:00	72.2	68.8	68.1	00:50	72.2	69.3	68.6	09:50	77.8	69.3	68.5
16:10	72.3	68.9	68.1	01:00	71.8	69.2	68.5	10:00	77.3	69.3	68.4
16:20	72.4	68.9	68.1	01:10	72.3	69.1	68.4	10:10	83.8	69.3	68.5
16:30	72.0	68.9	68.2	01:20	71.5	69.1	68.4	10:20	76.2	69.4	68.6
16:40	71.5	68.9	68.2	01:30	71.7	69.2	68.5	10:30	82.5	69.4	68.4
16:50	71.9	68.9	68.2	01:40	72.1	69.2	68.5	10:40	77.1	69.3	68.5
17:00	83.6	69.1	68.2	01:50	72.2	69.3	68.5	10:50	77.7	69.3	68.5
17:10	71.8	69.1	68.3	02:00	72.2	69.2	68.5	11:00	76.2	69.2	68.5
17:20	77.7	69.1	68.2	02:10	72.0	69.2	68.5	11:10	81.1	69.4	68.6
17:30	71.7	69.0	68.2	02:20	71.8	69.3	68.5	11:20	71.5	69.2	68.4
17:40	72.3	69.1	68.3	02:30	71.7	69.3	68.5	11:30	72.8	69.4	68.5
17:50	74.5	69.2	68.4	02:40	71.6	69.3	68.5	11:40	72.6	69.3	68.5
18:00	72.0	68.9	68.2	02:50	74.4	69.4	68.6				
18:10	72.2	69.0	68.2	03:00	72.1	69.2	68.5				
18:20	77.3	69.0	68.2	03:10	71.9	69.3	68.5				
18:30	80.5	69.0	68.2	03:20	71.9	69.3	68.6				
18:40	73.5	69.2	68.3	03:30	72.2	69.3	68.6				
18:50	72.4	69.1	68.4	03:40	72.8	69.2	68.5				
19:00	72.4	69.1	68.3	03:50	71.6	69.3	68.6				
19:10	72.5	69.0	68.2	04:00	72.2	69.2	68.5				
19:20	72.3	68.9	68.1	04:10	71.6	69.2	68.4				
19:30	72.1	69.0	68.2	04:20	72.2	69.3	68.5				
19:40	71.7	68.9	68.1	04:30	72.2	69.2	68.5				
19:50	72.1	68.9	68.1	04:40	74.5	69.3	68.6				
20:00	71.9	69.0	68.2	04:50	72.1	69.2	68.5				
20:10	71.9	69.0	68.2	05:00	72.2	69.3	68.5				
20:20	72.4	69.0	68.2	05:10	71.8	69.3	68.5				
20:30	72.1	69.0	68.2	05:20	71.6	69.2	68.5				
20:40	71.9	69.0	68.2	05:30	72.0	69.3	68.6				
20:50	71.7	69.0	68.2	05:40	71.9	69.3	68.6				
				05:50	72.3	69.2	68.5				

Calculations to MIC Windows (worst case)

	Royal College of Ophthalmologists, 18 Stephenson Way, Camden														
	to rear upper floor mansard windows of MIC building to north														
	07/03/13					Octave Band Centre Frequency, Hz									
	SUMMARY	distance (m)			dB	63	125	250	500	1000	2000	4000	dB(A)		
	roof plant	horiz	vert	distanc	shielding							**total**	**52.3**		
					background LA90			66	dB			difference	-13.7		
1	2x RYMQ18T7Y1B	9.6	3.5	10.22	0	51.8	50.8	51.8	49.8	44.8	40.8	35.8	50.8		
2	1x RYMQ16T7Y1B	9.6	3.5	10.22	0	52.8	50.8	49.8	44.8	38.8	35.8	29.8	46.5		
3	toilet extract fan	11.9	3.5	12.4	0	18.1	29.1	31.1	34.1	32.1	8.1	4.1	34.9		
4	lab extract fan	11.9	3.5	12.4	0	13.6	20.6	24.6	31.6	16.1	18.1	12.1	29.4		
5	AHU exhaust	20.3	3.5	20.6	5	32.7	31.2	29.2	24.7	22.7	13.2	14.2	27.2		
6	AHU fresh air inlet	20.3	3.5	20.6	5	28.7	29.7	25.7	14.7	14.7	6.7	7.7	21.2		
7	AHU casing breakout	20.3	3.5	20.6	5	33.7	25.7	16.7	16.7	16.7	5.7	5.7	19.9		
	basement plant														
8	AHU exhaust	9.6	13	16.16	0	40.3	38.3	32.8	28.8	26.3	25.3	28.3	33.5		
9	AHU fresh air inlet	9.6	13	16.16	0	36.3	37.3	27.8	26.8	12.3	13.3	8.3	27.1		
	INDIVIDUAL PLANT CALCULATIONS														
	Condensers														
1	**2x RYMQ18T7Y1B**														
	SPL @ 1m					66.0	65.0	66.0	64.0	59.0	55.0	50.0	65.0		
	Lp = SPL - 20 log d/dref + DI - shielding														
	d ref	1	m												
	d	10.22	m			20.2	20.2	20.2	20.2	20.2	20.2	20.2			
	DI	3	dB			3.0	3.0	3.0	3.0	3.0	3.0	3.0			
	shield	0	dB			0.0	0.0	0.0	0.0	0.0	0.0	0.0			
	number of units	2				3.0	3.0	3.0	3.0	3.0	3.0	3.0			
	Lp					51.8	50.8	51.8	49.8	44.8	40.8	35.8	50.8	dB(A)	
2	**1x RYMQ16T7Y1B**														
	SPL @ 1m					70.0	68.0	67.0	62.0	56.0	53.0	47.0	63.7		
	Lp = SPL - 20 log d/dref + DI - shielding														
	d ref	1	m												
	d	10.22	m			20.2	20.2	20.2	20.2	20.2	20.2	20.2			
	DI	3	dB			3.0	3.0	3.0	3.0	3.0	3.0	3.0			
	shield	0	dB			0.0	0.0	0.0	0.0	0.0	0.0	0.0			
	number of units	1				0.0	0.0	0.0	0.0	0.0	0.0	0.0			
	Lp					52.8	50.8	49.8	44.8	38.8	35.8	29.8	46.5	dB(A)	
3	**toilet extract fan**					62.0	68.0	67.0	69.0	69.0	71.0	67.0			
	min insertion loss Att 01					0.0	0.0	0.0	0.0	0.0	0.0	0.0			
	end reflection, 250mm, 250mm					13.0	8.0	4.0	1.0	0.0	0.0	0.0			
					Lw	49.0	60.0	63.0	68.0	69.0	71.0	67.0			
	Atmosphere			distance	12.4m	32.9	32.9	32.9	32.9	32.9	32.9	32.9			
		directivity : 90°,90°, 250mm, 250mm				2.0	2.0	1.0	-1.0	-4.0	-30.0	-30.0			
					Lp	18.1	29.1	31.1	34.1	32.1	8.1	4.1	34.9	dB(A)	
				a wtd		-8.1	13.0	22.5	30.9	32.1	9.3	5.1			
4	**lab extract fan**					57.0	60.0	66.0	74.0	71.0	71.0	64.0			
	generic attenuator, 600mm, 50% free area					1.0	2.0	7.0	10.0	11.0	9.0	8.0			
	end reflection, 250mm, 250mm					13.0	8.0	4.0	1.0	0.0	0.0	0.0			
					Lw	43.0	50.0	55.0	63.0	60.0	62.0	56.0			
	Atmosphere			distance	12.4m	32.9	32.9	32.9	32.9	32.9	32.9	32.9			
		directivity : 90°,30°, 600mm, 600mm				3.5	3.5	2.5	1.5	-11.0	-11.0	-11.0			
					Lp	13.6	20.6	24.6	31.6	16.1	18.1	12.1	29.4	dB(A)	
				a wrd		-12.6	4.5	16.0	28.4	16.1	19.3	13.1			

	calculation continued					Octave Band Centre Frequency, Hz								
						63	125	250	500	1000	2000	4000	dB(A)	
5	**AHU exhaust**					81.0	76.0	76.0	74.0	74.0	75.0	75.0		
	radiused bend, 500mm					0.0	0.0	1.0	2.0	3.0	3.0	3.0		
	generic attenuator, 600mm, 50% free area					1.0	2.0	7.0	10.0	11.0	9.0	8.0		
	end reflection, 500mm, 500mm					8.0	4.0	1.0	0.0	0.0	0.0	0.0		
					Lw	72.0	70.0	68.0	64.0	63.0	66.0	67.0		
	Atmosphere			distance	20.6m	37.3	37.3	37.3	37.3	37.3	37.3	37.3		
			directivity : 0°,90°, 500mm, 500mm			3.0	3.5	3.5	3.0	2.0	-10.5	-10.5		
					Lp	37.7	36.2	34.2	29.7	27.7	18.2	19.2	32.2	dB(A)
	shielding	5			nielding	32.7	31.2	29.2	24.7	22.7	13.2	14.2	27.2	dB(A)
6	**AHU fresh air inlet**					76	73.0	70.0	60.0	60.0	49.0	49.0		
	radiused bend, 500mm					0.0	0.0	1.0	2.0	3.0	3.0	3.0		
	generic attenuator, 600mm, 50% free area					1.0	2.0	7.0	10.0	11.0	9.0	8.0		
	end reflection, 500mm, 500mm					8.0	4.0	1.0	0.0	0.0	0.0	0.0		
					Lw	67.0	67.0	62.0	50.0	49.0	40.0	41.0		
	Atmosphere			distance	20.6m	37.3	37.3	37.3	37.3	37.3	37.3	37.3		
			directivity : 0°,0°, 500mm, 500mm			4.0	5.0	6.0	7.0	8.0	9.0	9.0		
					Lp	33.7	34.7	30.7	19.7	19.7	11.7	12.7	26.2	dB(A)
	shielding	5			nielding	28.7	29.7	25.7	14.7	14.7	6.7	7.7	21.2	dB(A)
7	**AHU casing breakout**		SWL			73	65.0	56.0	56.0	56.0	45.0	45.0	59.3	
	Lp = Lw - 20 log r - 11 + DI													
	r	20.60		20 log r		26.3	26.3	26.3	26.3	26.3	26.3	26.3		
	-11					-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0		
	DI		3			3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	shield		5			5.0	5.0	5.0	5.0	5.0	5.0	5.0		
	Lp					33.7	25.7	16.7	16.7	16.7	5.7	5.7	19.9	dB(A)
	Basement Plant													
	Basement Swegon AHU													
8	**AHU exhaust**					84.0	80.0	77.0	77.0	78.0	76.0	72.0		
	radiused bend, 500mm					0.0	0.0	1.0	2.0	3.0	3.0	3.0		
	radiused bend, 500mm					0.0	0.0	1.0	2.0	3.0	3.0	3.0		
	generic attenuator, 900mm, 40% free area					4.0	7.0	13.0	19.0	23.0	23.0	16.0		
	end reflection, 500mm, 500mm					8.0	4.0	1.0	0.0	0.0	0.0	0.0		
					Lw	72.0	69.0	63.0	58.0	55.0	53.0	56.0		
	Atmosphere			distance	16.2m	35.2	35.2	35.2	35.2	35.2	35.2	35.2		
			directivity : 45°,0°, 500mm, 500mm			3.5	4.5	5.0	6.0	6.5	7.5	7.5		
					Lp	40.3	38.3	32.8	28.8	26.3	25.3	28.3	33.5	dB(A)
	shielding	0			nielding	40.3	38.3	32.8	28.8	26.3	25.3	28.3	33.5	dB(A)
9	**AHU fresh air inlet**					77.0	74.0	67.0	68.0	55.0	53.0	47.0		
	radiused bend, 500mm					0.0	0.0	1.0	2.0	3.0	3.0	3.0		
	generic attenuator, 600mm, 50% free area					1.0	2.0	7.0	10.0	11.0	9.0	8.0		
	radiused bend, 500mm					0.0	0.0	1.0	2.0	3.0	3.0	3.0		
	end reflection, 500mm, 500mm					8.0	4.0	1.0	0.0	0.0	0.0	0.0		
					Lw	68.0	68.0	58.0	56.0	41.0	41.0	36.0		
	Atmosphere			distance	16.2m	35.2	35.2	35.2	35.2	35.2	35.2	35.2		
			directivity : 45°,0°, 500mm, 500mm			3.5	4.5	5.0	6.0	6.5	7.5	7.5		
					Lp	36.3	37.3	27.8	26.8	12.3	13.3	8.3	27.1	dB(A)
	shielding	0			nielding	36.3	37.3	27.8	26.8	12.3	13.3	8.3	27.1	dB(A)