

Italian Hospital Great Ormond Street Hospital

Plant Noise Assessment Report

27 February 2018

For Kier Construction Ltd 2 Langston Road Loughton Essex IG10 3SD



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SUMMARY

New plant items are proposed on the roof of the Italian Hospital building at Great Ormond Street Hospital in London. The new plant items will be subject to noise limitations imposed by the local authority, Camden Council.

A noise survey has been undertaken to determine background noise levels that are representative of the nearest noise sensitive properties, against which the plant noise can be assessed.

A noise assessment has been undertaken to predict noise emissions associated with the proposed plant at the nearest noise sensitive properties.

The predicted noise levels comply with Camden Council's requirements.

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1.0 Introduction

New plant items are proposed on the roof of the Italian Hospital building at Great Ormond Street Hospital in London. The new plant items will be subject to noise limitations imposed by the local authority, Camden Council.

This report presents the methodology and results of a noise survey to determine background noise levels that are representative of the nearest noise sensitive properties, as well as an assessment to address Camden Council's requirements.

2.0 Description of Site and Proposals

The building is located on the south-eastern side of Queen Square and is bounded by Queen Square to the north-west and Boswell Street to the south-east.

The building is surround mainly by buildings associated with Great Ormond Street Hospital. Residential properties were noted to the south-east of the site in Devonshire Court on the opposite side of Boswell Street.

Figure 2.1 shows the approximate site extent in **red** and surrounding properties.



Figure 2.1 Existing Site Extent and Surroundings

3.0 Camden Council Requirements

Condition 9 of the planning permission for the proposals (ref: 2017/3933/P) states the following:

"Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (LA90), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed in dB(A)."



4.0 Background Noise Survey Methodology

An unmanned environmental noise survey was undertaken over a typical 3-day period between Friday 29 September 2017 and Monday 2 October 2017. This measurement period was selected to assess background noise levels during typical daytime and night-time periods when the proposed plant will be operational.

The equipment used for the noise survey is described in Table 4.1.

Table 4.1 Description of Equipment used for Noise Survey

Item	Make & Model	Serial Number
Type 1 sound level meter	01dB Fusion	11388
Type 1 ½" microphone	GRAS 40CE	259634
Calibrator	01dB CAL21	34375252

 L_{Aeq} and L_{A90} sound pressure levels were measured throughout the noise survey over 15-minute intervals.

The noise monitoring equipment was calibrated before and after the noise survey period. No significant change was found. Laboratory equipment calibration certificates can be provided upon request.

The measurement position was located on the south-eastern boundary of the site, protruding from the roof over Boswell Street. The measurement position is considered to be representative of background noise levels at the nearest noise sensitive properties.

The measurement position is indicated on Figure 4.1.







Due to the nature of the noise survey, i.e. unmanned, we are unable to comment on the weather conditions throughout the entire noise survey period. However, at the beginning and end of the survey period, there was noted to be no rainfall, a clear sky and only light wind. These conditions are understood to be representative of the survey period and are considered appropriate for undertaking environmental noise measurements.

5.0 Noise Survey Results

Appendix B presents a time history graph showing the L_{Aeq} and L_{A90} sound pressure levels measured throughout the noise survey.

We would consider the levels measured to be reasonable, considering the location of the measurement position and the dominant nearby noise sources.

The lowest $L_{A90, T}$ background noise levels measured during the noise survey are summarised in Table 5.1.

Lowest N	leasured L _{A90, T} Background Noise	Level (dB)
Daytime (07:00 – 23:00 hours) T = 1 hour	Typical Working Hours (08:00 – 18:00 hours) T = 1 hour	Night-time (23:00 – 07:00 hours) T = 15 minutes
48	49	46

Table 5.1 Lowest Measured Background Noise Levels

Due to the nature of the unmanned noise survey we are unable to comment on the exact noise climate throughout the entire survey period. However, at the beginning and end of the survey period, the daytime noise climate at the measurement position was dominated by road traffic using Boswell Street. We would expect this to also be true of night-time periods.

6.0 Building Services Plant Noise Emissions

6.1 External Noise Limits

Based on the lowest measured background noise levels and Camden Council's requirements, the total cumulative building services noise due to all operating plant is to be limited to a level of **43 dB** during daytime periods, when measured at a position 1m external to the nearest sensitive façades.

The plant is not proposed to operate during night-time periods and, from inspection of the proposed plant noise data, is not anticipated to generate any distinguishable, discrete continuous notes (whine, hiss, screech, hum) or distinct impulses (bangs, clicks, clatters, thumps).

6.2 Proposed Plant

The plant is proposed to be located within internal and external plant areas at the north end of the roof, and within an external plant area at the south end of the roof. Each external plant area will be surrounded by solid screens, extending to a height of 2.8m above roof level (northern plant area) and 1.6m above roof level (southern plant area).

The plant items and their associated noise levels are listed in Table 6.1, with their approximate locations shown on Figure 6.1.



Plant Area	Plant Noise Source	Sound Pressure Level	
	Supply Air Handling Unit Intake	See Appendix C	
North	Supply Air Handling Unit Casing	60 dB L _{wA}	
(Internal)	Chiller 1	79 dB L _{wA}	
	Chiller 2	79 dB L _{wA}	
	Condenser	78 dB L _{wA}	
North	Condenser	78 dB L _{wA}	
(External)	Extract Air Handling Unit Discharge	See Appendix C	
	Extract Air Handling Unit Casing	59 dB L _{wA}	
	Supply Air Handling Unit Intake	See Appendix C	
South	Supply Air Handling Unit Casing	60 dB L _{wA}	
Journ	Extract Air Handling Unit Discharge	See Appendix C	
	Extract Air Handling Unit Casing	59 dB L _{wA}	

Table 6.1 List of Plant and Associated Noise Levels

Figure 6.1 Approximate Plant Locations



The air handling unit intake and discharge openings will be fitted with suitable attenuators providing the sound reduction performance presented in Appendix C.

6.2 Nearest Noise Sensitive Properties

The nearest noise sensitive properties, indicated on Figure 6.2 below, are noted to be:

- Devonshire Court, located on Boswell Street to the north-east of the site, at a distance of approximately 25m from the north plant area and 21m from the south plant area (indicated in green)
- Cecil House, located to the south-east of the site, at a distance of approximately 14m from the south plant area (indicated in **blue**) and several floor levels below



• The October Gallery, located to the south-west of the site, at a distance of approximately 14m from the south plant area (indicated in yellow) and several floor levels below



Figure 6.2 Noise Sensitive Properties

6.3 Plant Noise Predictions

Our calculations to predict the total noise level at the nearest noise sensitive properties with all external plant items operating simultaneously are presented in Tables 6.2 - 6.4, with detailed calculations for air handling unit intake and discharge noise emissions presented in Appendix C.



Plant Area	Plant Noise Source	Sound Power Level (L _{wA} dB)	Distance Attenuation (dB)	Screening Attenuation (dB)	Sound Pressure Level at Devonshire Court (dB)
	Supply Air Handling Unit Intake	S	ee Appendix C		26
North	Supply Air Handling Unit Casing				
(Internal)	Chiller 1	S	ee Appendix C		39
	Chiller 2				
North	Condenser	78	-33	-15	30
	Condenser	78 -33		-15	30
	Supply Air Handing Unit Intake	See Appendix C		26	
(External)	Supply Air Handing Unit Casing	60	-33	-15	12
	Extract Air Handing Unit Discharge	See Appendix C		29	
	Extract Air Handing Unit Casing	59	-33	-15	21
	Supply Air Handing Unit Intake	See Appendix C		22	
Cauth	Supply Air Handing Unit Casing	60	-31	-7	22
South	Extract Air Handing Unit Discharge	See Appendix C		27	
	Extract Air Handing Unit Casing	59	-31	-7	21
		Total Pre De	edicted Noise L evonshire Cour	.evel at t	41

Table 6.2 Plant Noise Emission Calculations – Devonshire Court

Noise Limit 43



Table 6.3	Plant Noise	Emission	Calculations –	Cecil House

Plant Area	Plant Noise Source	Sound Power Level (L _{wA} dB)	Distance Attenuation (dB)	Screening Attenuation (dB)	Sound Pressure Level at Cecil House (dB)
	Supply Air Handing Unit Intake	See Appendix C			25
Couth	Supply Air Handing Unit Casing	Supply Air Handing Unit Casing 60 -28 -1	-15	17	
South Extract Air Handing Unit Discharge See Appendix C		30			
	Extract Air Handing Unit Casing	59	-28	-15	16
		Total Predicted	Noise Level at	: Cecil House	31

Noise Limit 43		Noise Limit	43
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 Table 6.4 Plant Noise Emission Calculations – October Gallery

Plant Area	Plant Noise Source	Sound Power Level (L _{wA} dB)	Distance Attenuation (dB)	Screening Attenuation (dB)	Sound Pressure Level at October Gallery (dB)
	Supply Air Handing Unit Intake	Se	ee Appendix C		25
Couth	Supply Air Handing Unit Casing	60	-28 -15		17
South	Extract Air Handing Unit Discharge	See Appendix C	30		
	Extract Air Handing Unit Casing	59	-28	-15	16
		Total Predicte	ed Noise Level Gallery	at October	31

It can therefore be seen that the total predicted noise level associated with the proposed plant complies with Camden Council's requirements at the nearest noise sensitive properties during the proposed operating period.

Noise Limit

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Appendix A – Acoustic Terminology

Parameter	Description
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing ($20x10^{-6}$ Pascals).
Sound Pressure Level (L _p)	The sound pressure level is the sound pressure fluctuation caused by vibrating objects relative to the threshold of hearing.
A-weighting (L_A or dBA)	The sound level in dB with a filter applied to increase certain frequencies and decrease others to correspond with the average human response to sound.
L _{Aeq,T}	The A-weighted equivalent continuous noise level over the time period ${\sf T}$
	This is the sound level that is equivalent to the average energy of noise recorded over a given period.
L _{A90, T}	The noise level exceeded for 90% of the time (also referred to as the background noise level), measured over the time period T (typically T = 1 hour for daytime periods and 15 minutes for night-time periods, in accordance with BS 4142: 2014)



Appendix B – Time History Graph





Appendix C – Air Handling Unit and Plantroom Calculations

Devonshire Court

North Air Handling Unit – Supply Intake

Flowent			Octave E	Band Cent	re Freque	ency (Hz)		
Element	63	125	250	500	1k	2k	4k	8k
In-Duct Sound Power Levels	74	72	76	73	73	69	66	60
Attenuator Insertion Losses	-4	-7	-13	-19	-23	-23	-16	-13
Grille End Reflection	-3	-1	0	0	0	0	0	0
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6
Distance Attenuation	-34	-34	-34	-34	-34	-34	-34	-34
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5
Predicted Noise Level at Devonshire Court	33	30	30	21	17	13	17	14

North Internal Plantroom Break-Out

Flowert		Octave Band Centre Frequency (Hz)								
Element	63	125	250	500	1k	2k	4k	8k		
Total Internal Reverberant Level	79	75	72	69	64	62	57	47		
Louvre Area Correction	+12	+12	+12	+12	+12	+12	+12	+12		
Inside-to-Outside Correction	-6	-6	-6	-6	-6	-6	-6	-6		
Distance Attenuation	-33	-33	-33	-33	-33	-33	-33	-33		
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5		
Predicted Noise Level at Devonshire Court	47	43	40	37	32	30	25	14		



Element		Octave Band Centre Frequency (Hz)									
	63	125	250	500	1k	2k	4k	8k			
In-Duct Sound Power Levels	77	72	82	78	78	73	70	66			
Attenuator Insertion Losses	-4	-8	-14	-21	-27	-27	-21	-16			
Grille End Reflection	-3	-1	0	0	0	0	0	0			
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6			
Distance Attenuation	-34	-34	-34	-34	-34	-34	-34	-34			
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5			
Predicted Noise Level at Devonshire Court	36	29	35	24	18	13	16	17			

North Air Handling Unit – Extract Discharge

South Air Handling Unit – Supply Intake

Element	Octave Band Centre Frequency (Hz)									
Element	63	125	250	500	1k	2k	4k	8k		
In-Duct Sound Power Levels	74	72	76	73	73	69	66	60		
Attenuator Insertion Losses	-5	-10	-16	-25	-34	-34	-29	-22		
Grille End Reflection	-3	-1	0	0	0	0	0	0		
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6		
Distance Attenuation	-32	-32	-32	-32	-32	-32	-32	-32		
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5		
Predicted Noise Level at Devonshire Court	33	29	28	17	8	4	6	7		



Element	Octave Band Centre Frequency (Hz)									
	63	125	250	500	1k	2k	4k	8k		
In-Duct Sound Power Levels	77	73	81	79	78	73	68	64		
Attenuator Insertion Losses	-5	-10	-16	-25	-34	-34	-29	-22		
Grille End Reflection	-3	-1	0	0	0	0	0	0		
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6		
Distance Attenuation	-32	-32	-32	-32	-32	-32	-32	-32		
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5		
Predicted Noise Level at Devonshire Court	36	30	33	23	13	8	8	11		

South Air Handling Unit – Extract Discharge



Cecil House

South Air Handling Unit – Supply Intake

Flowsout	Octave Band Centre Frequency (Hz)									
Element	63	125	250	500	1k	2k	4k	8k		
In-Duct Sound Power Levels	74	72	76	73	73	69	66	60		
Attenuator Insertion Losses	-5	-10	-16	-25	-34	-34	-29	-22		
Grille End Reflection	-3	-1	0	0	0	0	0	0		
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6		
Distance Attenuation	-29	-29	-29	-29	-29	-29	-29	-29		
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5		
Predicted Noise Level at Cecil House	36	32	31	20	11	7	9	10		

South Air Handling Unit – Extract Discharge

Element	Octave Band Centre Frequency (Hz)									
	63	125	250	500	1k	2k	4k	8k		
In-Duct Sound Power Levels	77	73	81	79	78	73	68	64		
Attenuator Insertion Losses	-5	-10	-16	-25	-34	-34	-29	-22		
Grille End Reflection	-3	-1	0	0	0	0	0	0		
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6		
Distance Attenuation	-29	-29	-29	-29	-29	-29	-29	-29		
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5		
Predicted Noise Level at Cecil House	39	33	36	26	16	11	11	14		



October Gallery

South Air Handling Unit – Supply Intake

Element -	Octave Band Centre Frequency (Hz)									
	63	125	250	500	1k	2k	4k	8k		
In-Duct Sound Power Levels	74	72	76	73	73	69	66	60		
Attenuator Insertion Losses	-5	-10	-16	-25	-34	-34	-29	-22		
Grille End Reflection	-3	-1	0	0	0	0	0	0		
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6		
Distance Attenuation	-29	-29	-29	-29	-29	-29	-29	-29		
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5		
Predicted Noise Level at October Gallery	36	32	31	20	11	7	9	10		

South Air Handling Unit – Extract Discharge

Element	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
In-Duct Sound Power Levels	77	73	81	79	78	73	68	64	
Attenuator Insertion Losses	-5	-10	-16	-25	-34	-34	-29	-22	
Grille End Reflection	-3	-1	0	0	0	0	0	0	
Directivity (0°)	+4.5	+5	+5.5	+6	+6	+6	+6	+6	
Distance Attenuation	-29	-29	-29	-29	-29	-29	-29	-29	
Screening Attenuation	-5	-5	-5	-5	-5	-5	-5	-5	
Predicted Noise Level at October Gallery	39	33	36	26	16	11	11	14	