



Plant Noise Impact Assessment
Icon Manchester - Plot 4
Manchester
M90 5AA
Stroma Built Environment Ltd.
SBE Ref: 10-19-80328 – AC - 3v1

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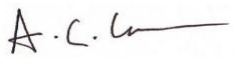
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I. Revision History

Revision	Date	Description		
3v1	09/04/2020	First Issue		
		Compiled By		Authorised By
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II. Executive Summary

Stroma Built Environment has been appointed by Winvic Construction to undertake an atmospheric noise impact assessment for the proposed Icon Manchester development.

The purpose of this assessment is to determine the noise impact of new sources of building services plant equipment associated with the development upon the existing noise climate at the nearest noise sensitive receptors. The assessment is undertaken in relation to the requirements of planning condition 12 determined by Manchester City Council.

The nearest noise sensitive receptors to the site, during the day and night-time, have been identified as residential dwellings situated off Sunbank Lane and Mill Lane

Based on resulting data of the site noise survey undertaken between Thursday 19th March and Monday 23rd March 2020, noise limits have been proposed for fixed plant noise emissions to satisfy the requirements of planning condition 12 at the nearest noise sensitive receptors.

Assessment of new items of external building services plant against the proposed atmospheric plant noise limits indicates that the cumulative noise level from all items of fixed plant would satisfy the rating noise limit at the nearest noise sensitive receptors during both the day and night-time periods, without any mitigation.

On this basis, it is considered that the requirements of planning condition 12 are met.

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1. Introduction

- 1.1 Stroma Built Environment (SBE) has been appointed by Winvic Construction (the client) to undertake an atmospheric noise impact assessment. The assessment relates specifically to fixed building services plant servicing a new industrial unit (Plot 4) at Icon, Manchester (the site), for the purposes of satisfying the requirements of planning condition 12 set by Manchester City Council.
- 1.2 The purpose of this report is to consider the acoustic impact of new fixed building services plant on the existing noise climate at the nearest noise sensitive receptors (NSR). The impact of noise from fixed building services plant has been assessed against the requirements of planning condition 12.
- 1.3 The assessment has been carried out in conjunction with noise emission limits derived from SBE's site noise survey. The survey was undertaken between Thursday 19th March and Monday 23rd March 2020.
- 1.4 Assessments are based on manufacturer supplied plant equipment data including type, locations, operating hours and noise emissions supplied to SBE.
- 1.5 This document has been prepared for the sole use, benefit and information of Winvic Construction for the purposes set out in the document or instructions commissioning the works. The liability of SBE in respect of the information contained herein will not extend to any third party.
- 1.6 This report is limited to addressing the specific acoustic issues contained herein and is based on information and drawings provided by the client.
- 1.7 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature. A glossary of terminology is included in Appendix V.

2. Standards and Planning Requirements

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'

- 2.1 BS 4142 describes a method for assessing the likelihood of complaints from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc.). The assessment methodology is based upon determining a 'rating level' for the equipment being assessed, which is the level of noise from the item or items of plant being assessed (measured as an L_{Aeq}). The rating level is then compared with the underlying background noise level (measured as an L_{A90}) in the absence of noise from the item or items of plant being assessed.
- 2.2 BS 4142 states that a penalty should be added for any plant which gives rise to noise features that may increase disturbance such as tonal, impulsive or intermittent characteristics. With respect to the acoustic feature correction, BS 4142 states:
- 2.3 *'Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level.'*
- 2.4 BS 4142 also notes that in instances where more than one acoustic character is present, the individual corrections should be summed. Generally, a rating penalty for a sound should be based on a subjective assessment of its characteristics.

Planning Condition 12

- 2.5 Planning permission has been granted by Manchester City Council subject to conditions. The relevant condition relating to fixed external plant noise is condition 12. The condition is replicated below:
- 2.6 *"(12) Any externally mounted ancillary plant, equipment and servicing required for each phase of development shall be acoustically treated in accordance with a scheme designed so as to achieve a noise level of 5dB below the existing background (L_{A90}) in each octave band at the nearest noise sensitive location. This should be in accordance with a scheme submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site.*

Reason - To safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 in the Core Strategy Development Plan Document."

3. Site Description

- 3.1 The development site (Plot 4) is located approximately 525 m south of M56 Junction 6 directly west of the A538 (Wilmslow Road). Manchester Airport runway is located approximately 800 m south east of the site. The proposed development comprises a large warehouse space with associated offices, ancillary spaces and service areas.
- 3.2 The site is predominantly bounded by other industrial/commercial buildings, with an Amazon warehouse and DHL service point situated immediately north west of the site. Airport parking, logistics services and other commercial buildings operate between the development site and the airport. The nearest residential dwelling is located approximately 450 south of Building Plot 4 as indicated in Table 1.
- 3.3 The nearest noise sensitive receptors (NSR) are residential dwellings situated off Mill Lane. The identified NSR's within the wider site context are generally indicated by turquoise icons of Figure 1. The site boundary is indicated by a yellow line.

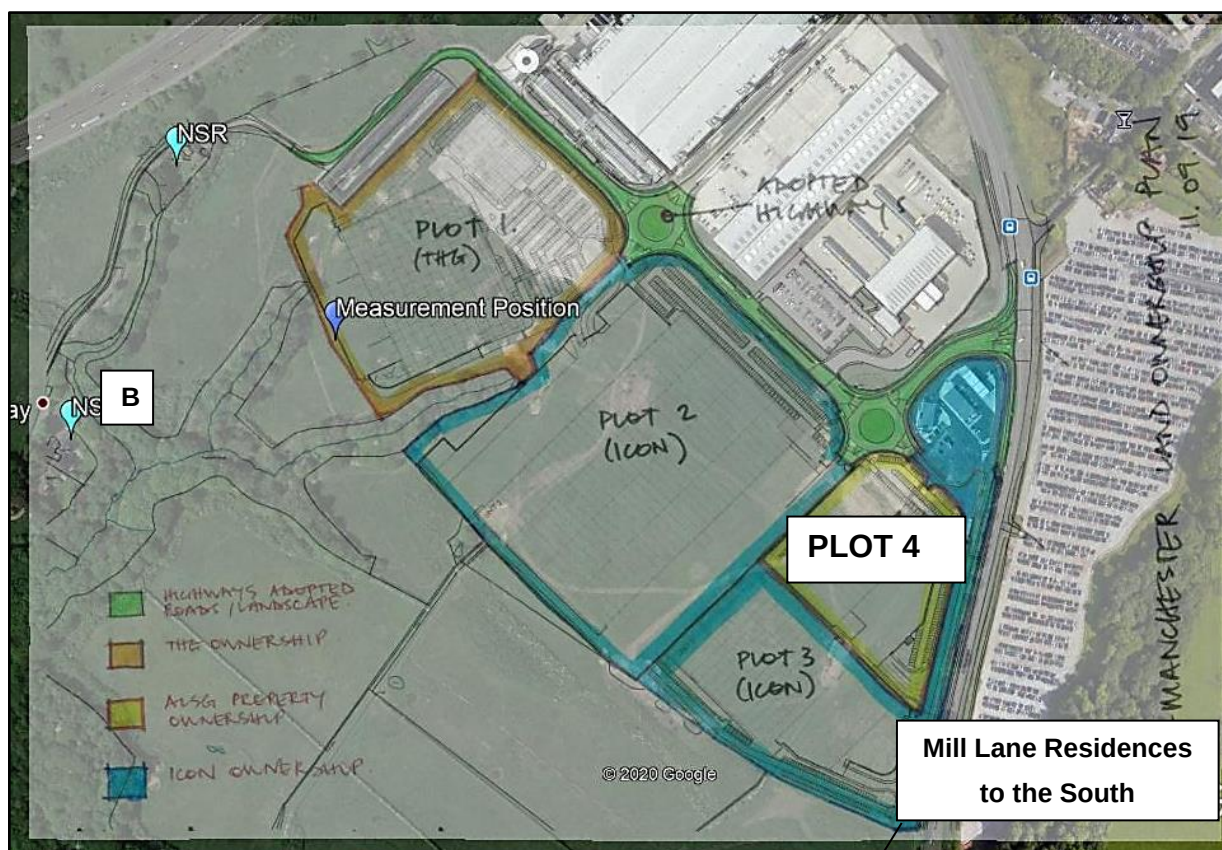


Figure 1: Location of site and nearest noise sensitive receptors

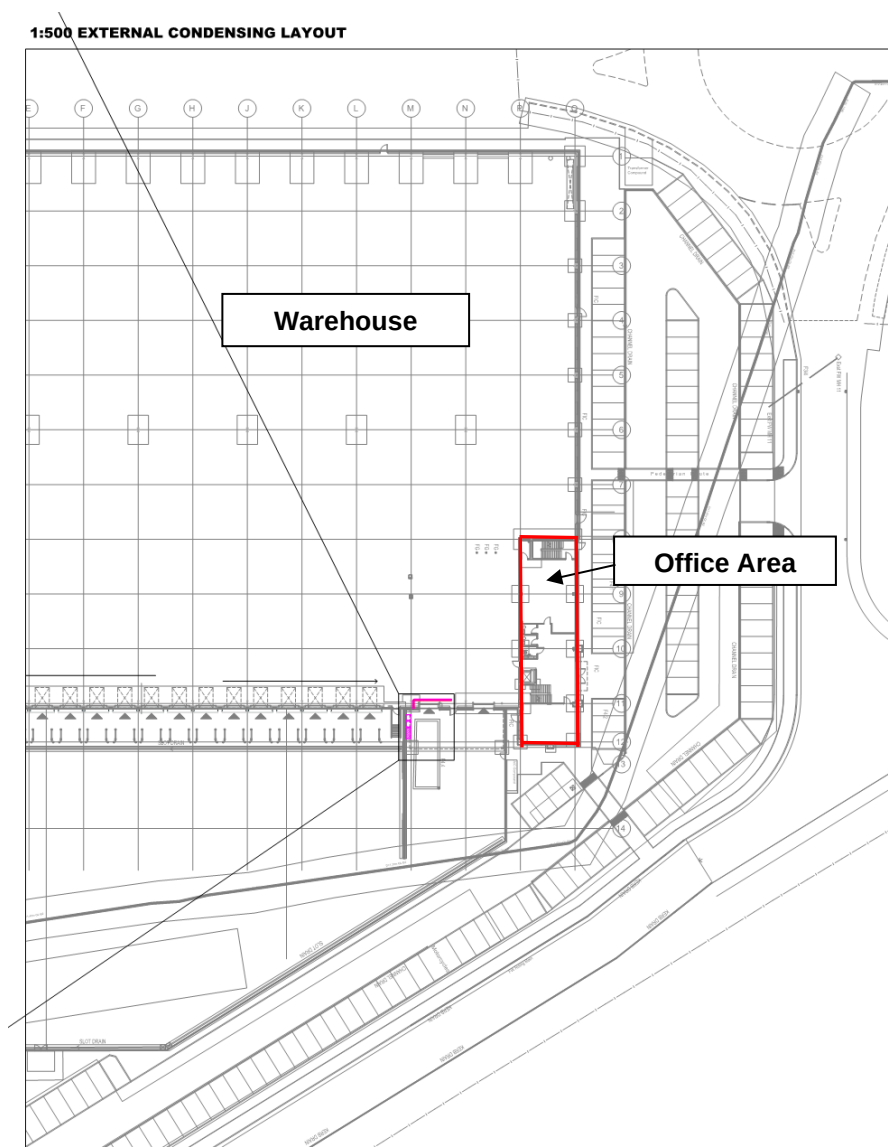
- 3.4 The development's fixed terminating/external plant comprises several heat recovery units, an external condenser and a ducted toilet extract fan.

- 3.5 A drawing extract showing the location of the offices where the building services plant is located is shown in Figure 2. Drawings presenting the unit areas including inclusive of items of building services and their specific locations are presented in Appendix II.

Table 1: Identified noise sensitive receptors

NSR	Description	Approximate Distance to Site Boundary
A	Residential dwelling – Mill Lane	450 m
B	Residential dwelling – Sunbank Lane	600 m

Figure 2: Indicative site layout plan



4. Noise Impact Assessment

- 4.1 A baseline noise survey was undertaken between Thursday 19th March and Monday 23rd March 2020 in order to determine prevailing background noise levels at the site and nearby NSR's. A summary of the noise survey results used to inform subsequent assessments, as well as the survey methodology, is provided in Appendix I Appendix I. The noise survey 'measurement position' is indicated by a blue icon on Figure 1.
- 4.2 A desktop noise impact assessment has been undertaken to assess the rating level at the most affected NSR using manufacturer's plant noise specification data provided by the client.
- 4.3 Plant specification data for each unit can be viewed in Appendix III.
- 4.4 Background sound levels ($L_{A90,T}$) from the noise survey data have been assessed to determine a representative background sound level for each period. Due to significant site works during the daytime, noise measurements between 8:00 – 17:00 have been excluded.
- 4.5 Table 2 below gives details of the plant noise limits at the nearest identified NSR locations.

Table 2: Fixed building services plant noise limits

NSR Location	Approx. distance from site boundary	Daytime (07:00 – 23:00)		Night-time (23:00 – 07:00)	
		Representative background noise level dB $L_{A90,T}$	Rating level to satisfy Planning Condition 12 (dB $L_{Ar,Tt}$)	Representative background noise level dB $L_{A90,T}$	Rating level to satisfy Planning Condition 12 (dB $L_{Ar,Tt}$)
A	450 m	49	44	46	41
B	600 m	49	44	46	41

- 4.6 The rating level described above should be assessed in accordance with BS 4142, including appropriate consideration of any tonal or impulsive characteristics of the proposed mechanical services plant.

Fixed Plant Noise Assessment

- 4.7 In order to assess the rating noise level from new items of plant operating cumulatively, calculations have been undertaken assuming all items of fixed plant are operating concurrently and continuously throughout each assessment period.
- 4.8 The assessment assumes that all plant may operate during the night-time period of 23:00 – 07:00, thereby providing a 'worst case' assessment.

- 4.9 Screening corrections have been applied in the calculations to take into consideration areas of the proposed development acting as a noise barrier between the item of plant and the NSR. It is understood that condensing plant is to be housed in a four-sided enclosure adjacent the offices with all internal plant ducted to atmosphere via the façade/roof.
- 4.10 The distance between each plant area and the NSRs have been approximated/measured using google earth in conjunction with architectural drawings supplied to SBE.
- 4.11 Where attenuators are proposed the insertion losses provided in the schedules included in Appendix III have been applied to calculations.
- 4.12 BS 4142 acoustic feature corrections have not been included in the calculations as based on the type of plant equipment and manufacturer noise data provided, SBE does not expect impulsive or tonal characteristics, or distinctive intermittency to the noise emitted.
- 4.13 Table 3 below presents a summary of the assessment. Detailed calculations are set out in Appendix IV.

Table 3: Fixed plant noise assessment

NSR Location	Period	Rating level to satisfy Planning Condition 12 (dB $L_{Ar,Tf}$)	Calculated rating level at receptor dB $L_{Ar,Tf}$	Rating level difference dB
A	Daytime	44	11	-33
	Night-time	41	11	-30
B	Daytime	44	10	-34
	Night-time	41	10	-31

- 4.14 The results presented in Table 3 indicate that the rating noise level from fixed plant associated with the unit would be more than 5 dB below the existing site representative background sound level for both daytime and night-time periods. In line with BS 4142 methodology, this is an indication of a 'low noise impact'.
- 4.15 In addition, based on review of manufacturer spectral octave band plant noise data where provided against SBE measured octave band background noise data, assessment indicates noise from building services plant across the spectrum would be of a level at least 5 dB below prevailing octave band background noise data as required by planning condition 12.

Estimate of Calculation Uncertainty

- 4.16 The assessment has been undertaken against site background sound level measurements. The uncertainty of noise survey measurements is expected to be ± 1 dB based on the allowable uncertainty for a calibrated Class 1 precision integrating sound level meter, quoted by BS 61672-1:2003 as ± 1.1 dB at 1 kHz.
- 4.17 Sound data for plant equipment has been taken from manufacturer quoted noise measurements. In accordance with BS EN ISO 3740:2001, the uncertainty of source measurements is expected to be between 1 dB and 2 dB in each octave band. A unit specific correction has been applied to the noise emission data to account for uncertainties in the measured data.
- 4.18 The uncertainty in a distance attenuation calculation over a distance < 100 m is quoted by ISO 9613-2:1996 as ± 1 dB for rooftop sources (> 5 m) and ± 3 dB for sources < 5 m from ground level.
- 4.19 It is considered that the maximum uncertainty in measurement and calculation is ± 3 dB.

5. Conclusions

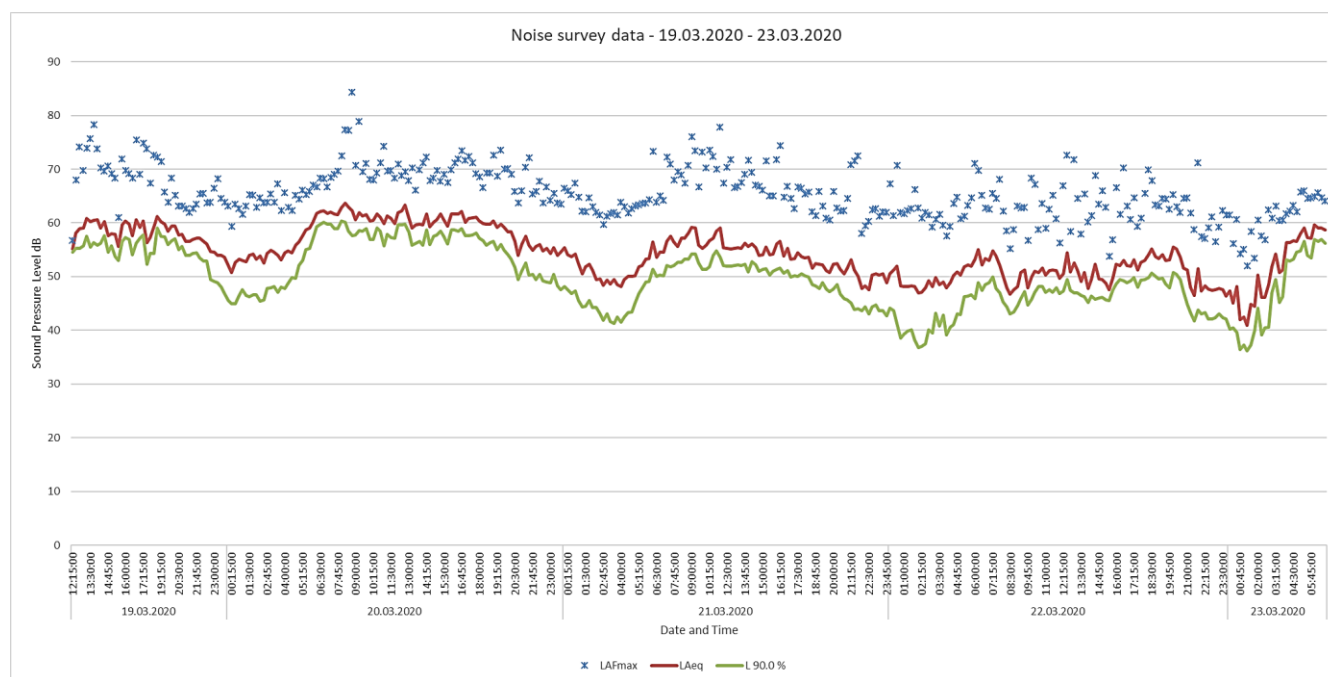
- 5.1 Stroma Built Environment has been appointed by Winvic Construction to undertake a fixed plant noise assessment for a new industrial unit (Plot 4) at Icon, Manchester for the purposes of satisfying the requirements of planning condition 12 determined by Manchester City Council.
- 5.2 The assessment has been undertaken using baseline noise survey data conducted between Thursday 19th March and Monday 23rd March 2020.
- 5.3 A desktop noise assessment has been carried out to assess the rating level at the nearby noise sensitive receptors using screening/distance attenuation calculations and manufacturer's noise specification data for items of building services plant serving Plot 4.
- 5.4 Assessment of plant noise specifications against the stated atmospheric plant noise limits indicates that atmospheric noise emissions from building services at the nearest NSRs would be more than 5 dB below the existing site representative background sound level during all assessment periods.
- 5.5 On this basis, it is considered that the requirements of planning condition 12 have been satisfied.

Appendix I. Survey Information and Data

A baseline noise survey was undertaken to assess the noise climate at and in the vicinity of the site over a representative period. Long term noise measurements were undertaken between Thursday 19th March and Monday 23rd March 2020.

Measurements were undertaken using an NTi XL2-TA Class 1 sound level meter, at a height of approximately 3 m above ground level and fitted with weather protection kit at all times. The sound level meter was field calibrated with no significant drift in calibration level detected. Weather conditions were generally fine and dry with wind speeds < 5ms⁻¹ noted.

The noise climate at the site, in the absence of construction noise, was found to be controlled primarily by motorway traffic noise from the M56 motorway and aircraft from Manchester Airport. Figure A1 presents full noise measurement survey data results for 'measurement position' (see Figure 1).



Parameter	63	125	250	500	1K	2K	4K	8K
Typical worst case L90	52	43	35	39	41	29	11	12

Figure A1: Long term monitoring results

Figure A2: Mechanical services ventilation layout (C0101/M201 Revision A)

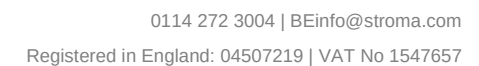
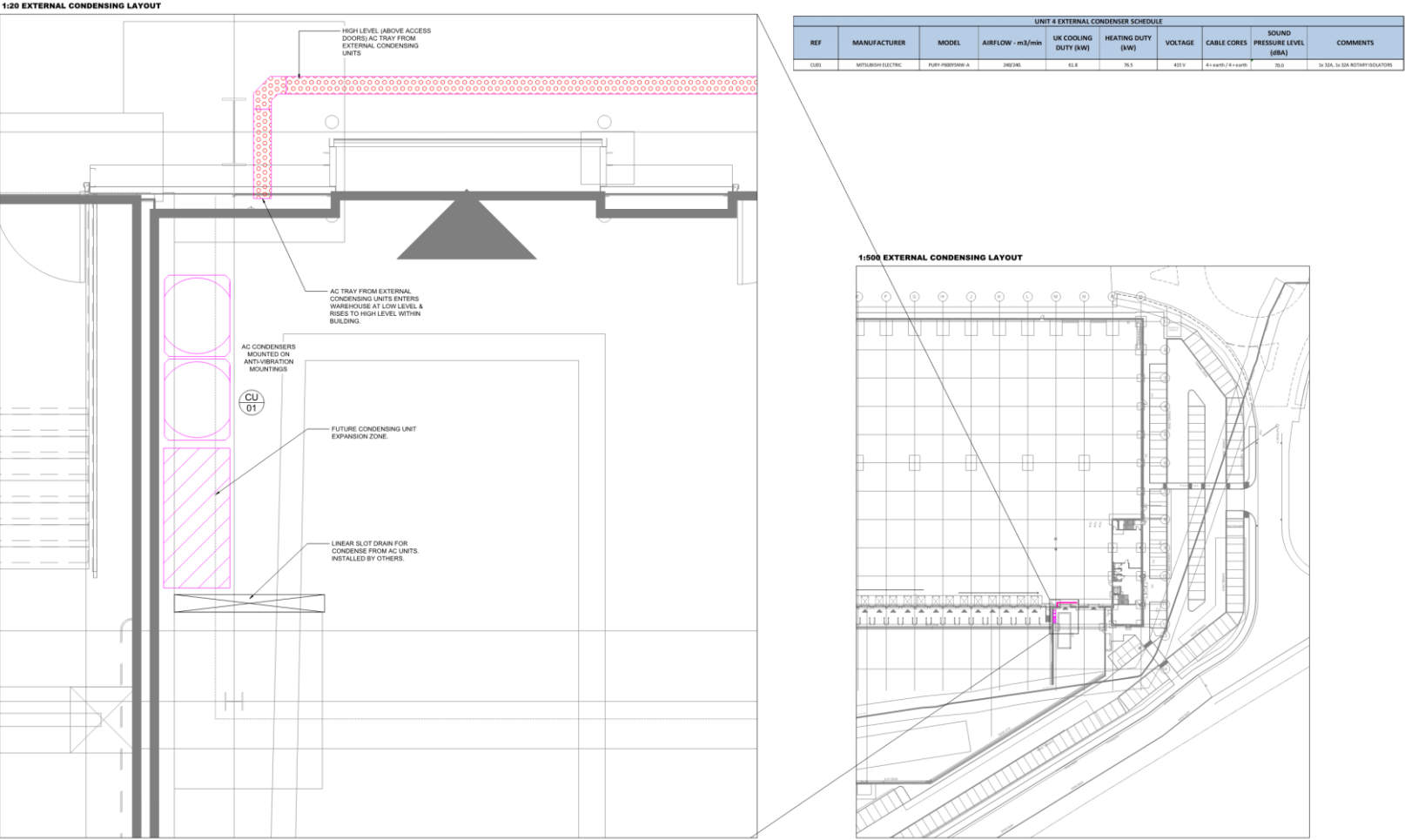


Figure A3: External condensing unit layout and housing (C0101/M602 Revision A)



Appendix III. Plant Data

Heat Recovery Units - Mitsubishi Lossnay LGH-RVX-E

LGH-RVX-E Commercial Series



COMMERCIAL MODELS		LGH15RVX-E	LGH25RVX-E	LGH35RVX-E	LGH50RVX-E	LGH65RVX-E	LGH80RVX-E	LGH100RVX-E	LGH150RVX-E	LGH200RVX-E
ELECTRICAL POWER SUPPLY		220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz	220-240V, 50Hz
RUNNING CURRENT (A)	SP1	0.10	0.10	0.12	0.13	0.15	0.15	0.17	0.29	0.33
	SP2	0.15	0.16	0.26	0.26	0.39	0.36	0.50	0.70	0.88
	SP3	0.24	0.28	0.54	0.59	0.90	0.83	1.20	1.75	2.20
	SP4	0.40	0.48	0.98	1.15	1.65	1.82	2.50	3.71	4.88
INPUT POWER (W)	SP1	7	8	11	12	15	18	21	38	42
	SP2	14	16	31	32	49	60	75	123	153
	SP3	28	33	70	78	131	151	200	311	400
	SP4	49	62	140	165	252	335	420	670	850
AIRFLOW (m³/h)²	SP1	38	63	88	125	163	200	250	375	500
	SP2	75	125	175	250	325	400	500	750	1000
	SP3	113	188	263	375	488	600	750	1125	1500
	SP4	150	250	350	500	650	800	1000	1500	2000
AIRFLOW (l/s)²	SP1	10	17	24	35	45	56	69	104	139
	SP2	21	35	49	69	90	111	139	208	278
	SP3	31	52	73	104	135	167	208	313	417
	SP4	42	69	97	139	181	222	278	417	556
SPECIFIC FAN POWER (W/(l/s))	SP1	0.70	0.47	0.46	0.34	0.33	0.32	0.30	0.37	0.30
	SP2	0.67	0.46	0.63	0.46	0.54	0.54	0.54	0.59	0.55
	SP3	0.90	0.63	0.96	0.75	0.97	0.90	0.96	0.99	0.96
	SP4	1.17	0.90	1.44	1.19	1.39	1.51	1.51	1.61	1.53
EXTERNAL STATIC PRESSURE (Pa)	SP1	6	5	10	8	8	10	11	11	10
	SP2	24	21	40	30	30	38	43	44	38
	SP3	54	48	90	68	68	85	96	98	84
	SP4	95	85	160	120	120	150	170	175	150
SOUND PRESSURE LEVEL (dBA)	SP1	17	17	17	18	18	18	18	18	18
	SP2	19	20	20	19	22	23	23	24	28
	SP3	24	22	28	28	29	30	31	32	36
	SP4	28	27	32	34	34.5	34.5	37	39	40

Unit Tested	Operating Fan Speed	Damper Position	Measured $L_{Aeq,1min}$ (dB)	L_{Zeq}							
				Octave band centre frequency, Hz dB							
				63 Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
NOVA 100 HRU Room Side	1	Closed	22	38.9	34.7	22.6	13.2	11.2	8.8	9.6	9.8
		Bypass	23	40.2	35.5	23.4	14.1	13.6	10.1	9.9	9.8
	2	Closed	34	48.4	46.8	35.2	29.8	23.2	18.2	11.8	10.8
		Bypass	35	49.7	48.0	37.6	29.6	23.6	19.9	12.6	10.9
	3	Closed	44	56.3	54.6	45.6	39.2	36.6	32.4	24.2	21.3
		Bypass	44	57.0	55.3	47.4	38.7	36.3	32.4	24.1	21.2
	4	Closed	51	64.6	60.0	51.8	46.0	44.4	41.3	33.5	30.6
		Bypass	51	63.7	60.6	53.8	45.4	44.0	40.6	33.4	31.1
NOVA 100 HRU Atmosphere Side at 1m from louver	1	Closed	33	46.4	37.7	36.7	30.1	27.3	20.8	12.7	10.5
		Bypass	35	50.3	41.6	38.7	31.5	29.1	22.9	13.5	10.8
	2	Closed	43	50.5	46.3	47.7	41.2	35.1	31.9	27.8	19.6
		Bypass	46	54.0	50.3	50.7	42.8	37.5	35.8	34.4	26.5
	3	Closed	54	58.3	55.9	56.9	50.5	46.9	44.8	42.3	35.8
		Bypass	56	59.2	57.2	59.6	51.7	49.8	47.4	45.4	40.4
	4	Closed	62	64.6	62.5	63.9	57.1	55.8	53.0	49.8	45.2
		Bypass	63	65.2	63.3	66.0	57.5	58.1	54.7	52.7	47.4

Spectral noise data of a Kelvinair Nova 100 Heat Recovery Unit measured by SBE has been used for assessment of HRU's. This unit is considered a rebadged Mitsubishi Lossnay and data is as such deemed to be representative.

Toilet Extract Fan – Vent Axia SENT100T

Technical Information

Stock Reference	SENT100T
Product Type	Ventilation
Product Range	Twin Fans
Impeller	Backward Curved
Casing	Aluzinc
Speed	Variable
Airstream Temperature	-25°C to 60°C
dBA	36 dBA @ 3m
Warranty	Up to 5 years

Electrical Information

Supply Voltage	220-240V/1/50Hz
Full Load Current	0.69 A
Starting Current	0.69 A
Insulation	B
Motor IP Rating	IP44
Speed Controllable	In Built

Sound Information at Duty Point

	63	125	250	500	1k	2k	4k	8k	Total	dBA@3m
Inlet	55	63	56	53	49	45	38	34	65	35
Outlet	53	65	59	58	54	55	48	39	67	40
Breakout	65	69	61	50	42	40	37	36	71	36

External Condenser – Mitsubishi PURY-P600YSNW-A

OUTDOOR UNITS		PURY-P600YSNW-A	PURY-P650YSNW-A	PURY-P700YSNW-A	PURY-P750YSNW-A	PURY-P800YSNW-A	PURY-P850YSNW-A
CAPACITY (kW)	Heating (nominal)	76.5	81.5	88.0	95.0	100.0	108.0
	Cooling (nominal)	69.0	73.0	80.0	85.0	90.0	96.0
	High Performance Heating (UK)	72.7	77.4	83.6	89.5	94.0	97.2
	CCP Priority Heating (UK)	69.6	74.2	80.1	81.7	86.0	92.9
	Cooling (UK)	61.8	65.3	71.6	76.1	80.6	85.9
POWER INPUT (kW)	Heating (nominal)	17.62	19.36	21.56	24.86	28.16	28.49
	Cooling (nominal)	16.62	18.19	20.72	22.30	23.93	24.99
	High Performance Heating (UK)	23.43	25.74	28.67	28.09	31.82	32.19
	CCP Priority Heating (UK)	17.62	19.36	21.56	24.11	27.32	27.64
	Cooling (UK)	9.64	10.55	12.02	12.93	15.32	15.99
COP / EER (nominal)		4.34 / 4.15	4.21 / 4.01	4.08 / 3.86	3.82 / 3.81	3.56 / 3.76	3.79 / 3.84
SCOP / SEER		-	-	-	-	-	-
MAX No. OF CONNECTABLE INDOOR UNITS		50	50	50	50	50	50
MAX CONNECTABLE CAPACITY		50~150% O/U Capacity	50~150% O/U Capacity	50~150% O/U Capacity	50~150% O/U Capacity	50~150% O/U Capacity	50~150% O/U Capacity
AIRFLOW (m³/min)	High	240 / 240	240 / 250	250 / 250	250 / 315	315 / 315	315 / 315
	Low	240 / 240	240 / 250	250 / 250	250 / 315	315 / 315	315 / 315
PIPE SIZE mm (in)	Gas	28.58 (1-1/8")	28.58 (1-1/8")	34.93 (1-3/8")	34.93 (1-3/8")	34.93 (1-3/8")	41.28 (1-5/8")
	Liquid	22.2 (7/8") / 28.58 (1-1/8")	28.58 (1-1/8")	28.58 (1-1/8")	28.58 (1-1/8")	28.58 (1-1/8")	28.58 (1-1/8")
SOUND PRESSURE LEVEL (dBA) @ 1m		70.0 / 64.0	69.0 / 65.0	67.0 / 65.5	70.5 / 67.0	72.0 / 68.0	72.5 / 68.5

Attenuator Schedule

27	UNIT 4																				
28	ATT01 HRU01 SUPPLY	SL348	GE	A18G	600	150	280	205	--	--	15	1	IL	2	6	10	18	28	23	20	12
29	ATT02 HRU01 FAI	PL	G	A13G	600	150			--	--	6	1	IL	1	2	6	16	23	19	17	12
30	ATT03 HRU01 EXTRACT	SL348	GE	A18G	600	150	280	205	--	--	15	1	IL	2	6	10	18	28	23	20	12
31	ATT04 HRU01 EXHAUST	PL	G	A13G	600	150			--	--	6	1	IL	1	2	6	16	23	19	17	12
32	ATT05 HRU02 SUPPLY	SL450	GE	A18G	900	250	400	305	--	--	29	1	IL	4	7	14	22	29	22	19	11
33	ATT06 HRU02 FAI	PL	G	A13G	600	250			--	--	8	1	IL	1	2	6	15	20	15	14	10
34	ATT07 HRU02 EXTRACT	SL450	GE	A18G	900	250	400	305	--	--	29	1	IL	4	7	14	22	29	22	19	11
35	ATT08 HRU02 EXHAUST	PL	G	A13G	600	250			--	--	8	1	IL	1	2	6	15	20	15	14	10
36	ATT09 SUP X-TALK	PL	G	A13G	900	200			--	--	10	1	IL	1	3	7	19	28	23	20	15

Item	System Reference	Code	Suffix	DWG	L1	L2/D	W	H/Dia	Vol	PD	Wt	No.	Performance, dB									
37	ATT10 EXT X-TALK	PL	G	A13G	900	200			--	--	10	1	IL	1	3	7	19	28	23	20	15	
38	ATT11 HRU03 SUPPLY	SL450	GE	A18G	900	250	400	305	--	--	29	1	IL	4	7	14	22	29	22	19	11	
39	ATT12 HRU03 FAI	PL	G	A13G	600	250			--	--	8	1	IL	1	2	6	15	20	15	14	10	
40	ATT13 HRU03 EXTRACT	SL450	GE	A18G	900	250	400	305	--	--	29	1	IL	4	7	14	22	29	22	19	11	
41	ATT14 HRU03 EXHAUST	PL	G	A13G	600	250			--	--	8	1	IL	1	2	6	15	20	15	14	10	
42	ATT15 SUP X-TALK	PL	G	A13G	900	200			--	--	10	1	IL	1	3	7	19	28	23	20	15	
43	ATT16 EXT X-TALK	PL	G	A13G	900	200			--	--	10	1	IL	1	3	7	19	28	23	20	15	

Appendix IV. Calculations

Figure A4: External plant assessment calculations – NSR A (worst case period)

Noise sensitive receptor (NSR)	Noise sources within All Site plant area	Number of units	Minimum distance to NSR, m	Sound power level, L_{wA} dB	Distance attenuation, dB	Correction for number of units, dB	Barrier loss, dB	Sound pressure level at NSR, $L_{Aeq,T}$
NSR A	HRU 01 FAI	1	600	61	-64			-3
	HRU 01 Exhaust	1	600	61	-64			-3
	HRU 02-03 FAI	2	600	61	-64	3		1
	HRU 02-03 Exhaust	2	600	61	-64	3		1
	Vent Axia SENT 100T Toilet Extract	1	600	61	-64		-5	-8
	Mitsubishi PURY-P600YSNW-A	1	600	78	-64		-5	9
Total sound pressure level at receptor, $L_{Aeq,T}$ dB								11
Correction for intermittency incorporated to result, dB								0
Correction for tonality incorporated to result, dB								0
Calculated plant noise rating level, $L_{Ar,T}$ dB								11
BS 4142:2014 plant noise rating level criterion, $L_{Ar,T}$ dB								41
Difference, dB								-30

Figure A5: External plant assessment calculations – NSR B (worst case period)

Noise sensitive receptor (NSR)	Noise sources within All Site plant area	Number of units	Minimum distance to NSR, m	Sound power level, L_{WA} dB	Distance attenuation, dB	Correction for number of units, dB	Barrier loss, dB	Sound pressure level at NSR, $L_{Aeq,T}$
NSR B	HRU 01 FAI	1	675	61	-65			-4
	HRU 01 Exhaust	1	675	61	-65			-4
	HRU 02-03 FAI	2	675	61	-65	3		0
	HRU 02-03 Exhaust	2	675	61	-65	3		0
	Vent Axia SENT 100T Toilet Extract	1	675	61	-65		-5	-9
	Mitsubishi PURY-P600YSNW-A	1	690	78	-65		-5	8
Total sound pressure level at receptor, $L_{Aeq,T}$ dB								10
Correction for intermittency incorporated to result, dB								0
Correction for tonality incorporated to result, dB								0
Calculated plant noise rating level, $L_{A,r,T,r}$ dB								10
BS 4142:2014 plant noise rating level criterion, $L_{A,r,T,r}$ dB								41
Difference, dB								-31

Appendix V. Acoustic Glossary

Sound pressure level and the decibel, dB

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. The decibel is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Frequency and hertz, Hz

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz. The human range of hearing is commonly accepted to be 20 Hz to 20,000 Hz. Additionally, an octave can be used to describe the interval between a frequency in Hz and either half or double that frequency.

Frequency weighting

Different weighting networks can be applied to a given sound level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The most commonly used weighting network is the 'A' weighting, and the letter 'A' will be included within a descriptor to indicate that the value has been 'A' weighted, e.g. $L_{Aeq,T}$ or L_{A90} . An 'A' weighted noise level may also be written as dB(A). Other weightings less commonly used are 'C' and 'D' weighting.

Noise indices

When a noise level varies with time, the measured 'A' weighted dB level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple 'A' weighted dB value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The various indices used are described as below:

$L_{Aeq,T}$	The 'A' weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, T
L_{Amax}	The maximum 'A' weighted noise level that was recorded during the monitoring period.
L_{A10}	The 'A' weighted noise level that was recorded for at least 10% of the monitoring period.
L_{A90}	The 'A' weighted noise level that was recorded for at least 90% of the monitoring period, usually taken as the underlying 'background' noise level.

Sound level difference, D

The sound level difference between two internal spaces, or between internal and external spaces. The ' D ' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to

describe an overall performance. Note that the 'D' value will always describe an in-situ or on-site acoustic performance. All values are described using the decibel.

D_w	Single figure weighted sound level difference, simply the measured source noise level minus receiver noise level, not adjusted to reference conditions
$D_{nT,w}$	Weighted normalised sound level difference – a single, weighted sound insulation value, normalised to a reference reverberation time using the measured reverberation time in the receive room
$D_{nT,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
$D_{nf,w}$	Overall flanking normalised level difference - A parameter that defines the flanking transmission of sound from room to room where a dividing partition or floor construction abuts a flanking building element common to both rooms, such as the building façade or ceiling

Sound reduction index, R

This describes the sound transmitted through a material or building element, such as a wall, door or window. It is measured in a laboratory with suppressed flanking transmission. The 'R' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to describe an overall performance. All values are described using the decibel.

R_w	Weighted single figure sound reduction index
$R_w + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
R'_w	The 'apparent sound reduction index', a field measurement to obtain the sound reduction index of a material or element, with all effects of site installation accepted.

Standardised impact sound pressure level, $L'_{nT,w}$

$L'_{nT,w}$ is the single figure used to characterise the impact sound pressure level in a receiving room, normalised to a reference reverberation time. Impact noise can be classified as (but is not limited to) the result of footfall impact on a separating floor to a habitable space below. All values are described using the decibel.

Reverberation time, T and T_{mf}

The reverberation time of a space is a measure of the rate at which sound decays, measured in seconds. It is defined as the time taken for the sound pressure level to reduce by 60 dB from its original impulse level. Reverberation time is commonly quoted in terms of the mid-frequency reverberation time, T_{mf} , the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands.

Absorption Coefficient

The acoustic absorption provided by a surface is defined as the sound absorption coefficient α , which denotes the fraction of sound energy absorbed between 0 (no absorption) and 1 (no reflection). The absorption coefficient of a material varies with the frequency of incident sound waves, therefore is considered for different frequencies.

Absorption Class

Based on the absorption coefficients, the overall sound absorption of a material is classified from Class A to Class E as defined in BS EN ISO 11654:1997, with Class A providing the highest level of acoustic absorption.

Noise rating, NR

The noise rating or NR system is commonly used in the design of noise emitted by internal building services systems. The system is frequency dependent, and was empirically derived to prevent disturbance to occupants in habitable or working areas from building services noise that exhibits 'tonal' elements, e.g. rumbles, whines, whistles etc. There is no direct relationship between the average 'A' weighted noise level in dB and the NR. However, as a guide, and assuming the absence of strong low frequency content in a given noise, the NR could generally be said to be 6 dB less than the average 'A' weighted dB value.

Privacy

Privacy is the addition of the level of sound insulation between two rooms and the background noise within a receiving room. It can be used to assess the level of privacy afforded in the 'receiving room' for speech from the 'source room'. The 'privacy factor' is a unit-less value that is the combination of the average 'A' weighted background noise level in dB and the weighted sound level difference (D_w) in dB.

Appendix VI. SBE Acoustic Credentials

SBE have specialised in providing the UK Construction Industry with a range of acoustics services since 2006. Specialising in Building Acoustics, all SBE acousticians are members of the Institute of Acoustics.

SBE is accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) (Testing Laboratory Number 2731).

SBE meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

This report has been authorised by Andrew Gibson, Principal Acoustic Consultant who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;

1. Holds an MEng degree in Electronic and Electrical Engineering from the University of Birmingham
2. Has been an Acoustic Consultant for more than three year's (within the last five years). This experience includes a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.
3. Holds Membership of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed by Andrew Gibson and has been found to;

1. Represent sound industry practice
2. Be appropriate given the building being assessed and scope of works proposed
3. Avoid invalid, biased and exaggerated recommendations.

Appendix VII. Report Conditions

This document has been prepared for the sole use, benefit and information of the Client. The liability of Stroma Built Environment Ltd. in respect of the information contained herein will not extend to any third party unless prior agreement is obtained in writing from Stroma Built Environment Ltd.

This report is limited to addressing the specific acoustic issues contained herein. Advice has been provided for acoustic reasons only and it is recommended that appropriate expert advice be sought on all the ramifications, e.g. safety, fire, structural, CDM etc., associated with any proposals contained herein.

The in-situ performance of acoustic measures is influenced to a large extent by the quality of workmanship and compliance with the specifications on-site during construction, as such, Stroma Built Environment Ltd. accepts no liability for issues with acoustic performance arising from such factors.

Acoustic survey and testing work carried out for the project is representative of the prevailing conditions at the time of the work. Conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

In particular, it should be noted that where calculations are carried out that are based on assumptions regarding certain aspects where information has not been supplied, these are provided for indicative purposes only and should be treated as such.