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NOISE IMPACT ASSESSMENT REPORT - KITCHEN EXTRACTION SYSTEM

31 COOMBE ROAD, NORBITON KT2 7AY

FOR

NA ARCHITECTS LTD

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1. EXECUTIVE SUMMARY

The Client intends to seek planning approval for a change of use to a restaurant/hot food takeaway (E(b) usage) as a result of which it is proposed to install mechanical plant (Kitchen Extraction System) to service the premises at 31 Coombe Road, Norbiton KT2 7AY.

Sound Licensing has undertaken an environmental noise survey at the site in order to determine prevailing background noise levels that are representative of the nearest noise sensitive property, which has been identified as the first-floor residential premises above the site at 1-2 Wolverton Avenue, KT2.

The results of the noise survey are considered reasonable given the location of the measurement position and the existing noise sources in the local vicinity.

Noise calculations of the mechanical plant have been undertaken using all available details and plans provided by the client and obtaining manufacturers' specifications wherever possible. The data and information form the basis of the assessment.

Noise break-out limits for the mechanical plant have been proposed based on the methodologies of British Standard (BS) 4142:2014 and in accordance to Local Authority policy. A robust, worst-case assessment of the noise levels associated to the proposed mechanical plant has been undertaken.

In accordance with BS 4142:2014 guidance, the predicted noise impact due to the operation of the mechanical plant ***"is an indication of the specific sound source having a low impact"***. The predicted noise level of the mechanical plant at the nearest noise sensitive properties is considered to comply with the London Borough of Kingston Upon Thames Council's policy.

2. INTRODUCTION

The client is proposing to install a new kitchen extraction system at the rear of 31 Coombe Road, Norbiton KT2 7AY, the noise from which could have the potential to affect existing noise sensitive properties nearby.

The purposes of this report are:

- To determine prevailing environmental noise levels affecting surrounding properties due to nearby noise sources (e.g. road traffic, aircraft etc);
- Based on the above, to present noise emission limits in accordance with the requirements of BS 4142:2014 and Local Authority policy, and
- To undertake an assessment to demonstrate compliance with the Local Authority noise requirements.

3. SITE DESCRIPTION

Planning permission is being sought for the change of use to E(b) (Restaurant/Hot Food Takeaway) at 31 Coombe Road, Norbiton KT2 7AY (hereafter referred to as 'the site'). The property is a traditionally built three-storey semi-detached building in the London Borough of Kingston Upon Thames. It is located in a mixed area comprising predominantly of commercial units at ground floor level with residential accommodation on the floors above.

The nearest sensitive residential receptors were noted to be the first-floor windows located on the rear façade of 31 Coombe Road at an approximate distance of 2m from the flue terminus.

The nearest sensitive receptors are identified in figure 3.1. If the noise impact assessment details that there is an indication of the specific sound source having a low impact at these premises then it can be safely assumed it will be met at other properties of equal distance and/or those further away.

Figure 3.1 shows the site highlighted in **blue** with the nearest noise sensitive premises highlighted in **red**.

Figure 3.1 Site Location and Surrounding Land Use

Source: Google Maps

4. ENVIRONMENTAL NOISE SURVEY METHODOLOGY

An unmanned environmental noise survey was undertaken at a single measurement location at ground floor level to the rear of the site. The survey was undertaken between 13:00 hours on the 28th May and 13:00 hours on the 1st June 2021. A survey at this time covers the most sensitive period of time in which the mechanical plant system may be operational.

Ambient, background and maximum noise levels (L_{Aeq}, L_{A90} and L_{Amax} respectively) were measured throughout the noise survey in continuous 15-minute periods. The approximate measurement position is indicated in **orange** on Figure 4.1 below.

Figure 4.1 Site Plan Showing Approximate Location of Measurement Position

Source: Google Maps

The sound level meter microphone was positioned on a tripod at a height of 1.5 metres, 1 metre from the rear façade of the building at ground floor level. The position is not considered to be in free-field and therefore a 3dB façade correction will be applied. The monitoring position is considered representative of background noise levels at the nearest identified noise sensitive properties. The monitoring position was chosen for equipment security reasons also.

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

Table 4.1 Description of Equipment used for Noise Survey

Equipment	Description	Quantity	Serial Number
Larson Davis Sound Expert LxT	Type 1 automated logging sound level meter	1	0004702
Larson Davis 377B02	½" microphone	1	159519
Larson Davis	Pre-amplifier	1	042610
Larson Davis CAL200	Class 1 Calibrator	1	11867

The noise survey and measurements were conducted in accordance with BS7445-1:2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*'.

Weather conditions throughout the entire noise survey period were noted to be warm (approx. 8-25° Celsius), passing clouds (0 to 30% cloud cover approximately) with a light wind (<5m/s). These weather conditions were checked against and confirmed by the use of the Met Office mobile application available on smart phone technology. These conditions were maintained throughout the majority of the survey period and are considered reasonable for undertaking environmental noise measurements.

The noise monitoring equipment was field calibrated before and after the noise survey period. No significant drift was recorded (±0.3 dB). Equipment calibration certificates can be provided upon request.

5. NOISE SURVEY RESULTS AND OBSERVATIONS

5.1 Results

A summary of the measured ambient and lowest background noise levels during the proposed operational hours are shown in Table 5.1 below (full monitoring data can be found in Appendix C).

Table 5.1 Measured ambient and lowest background sound pressure levels

Date / Period (hours)	Ambient Sound Pressure Level, dB $L_{Aeq,1hour}$	Lowest Background Sound Pressure Level, dB $L_{A90,1hour}$
28/05/2021(09:00 to 22:00)	**47-53***	**36***
29/05/2021(09:00 to 22:00)	**45-51***	**34***
30/05/2021(09:00 to 22:00)	**46-54***	**33***
31/05/2021(09:00 to 22:00)	**46-52***	**35***
01/06/2021(09:00 to 22:00)	**47-52***	**40***

*Façade correction -3dB

The lowest background noise level at the measurement position during the survey, at the time in which the plant could be operational, is **33dB** $L_{A90,1hour}$.

5.2 Observations

Given that the noise survey was unmanned, noise sources could not be identified. However, at the beginning and end of the survey background noise was dominated by noise from the vehicles on the local road network and rail noise. After analysis of the data no significant abnormal noise source(s) were identifiable. It is considered that the measured noise levels are reasonable given the location of the measurement position.

6. EXTERNAL NOISE EMISSION LIMITS

6.1 Local Authority Requirements

The site lies within the jurisdiction of the Local Authority, The Royal Borough of Kingston Upon Thames. Previous planning applications have had the following acoustic condition placed on the granted permission:

> The rating level of the noise determined by the cumulative sound emissions of the plant hereby permitted shall be at least 5dBA lower than the existing background noise level at any given time of operation. The noise levels shall be determined at any point externally to any window at the nearest residential façade. Measurements and assessment shall be carried out in accordance with British Standard 4142:1997.

For the purposes of this report, an assessment has been undertaken in line with BS 4142:2014. A design criterion of achieving a minimum 5dB(A) below the lowest background noise level has been adopted in line with the Local Authorities policy. Taking the noise monitoring data in Section 5 and Local Authority requirements above, the following design target has been adopted for mechanical plant as provided in Table 6.1.

Table 6.1 Maximum noise emission design target at residential premises

Date / Period (hours)	Lowest Background Sound Pressure Level, dB $L_{A90,1hour}$	Rating noise level at nearest residential facade, dB $L_{Aeq,T}$
30/05/2021(09:00 to 22:00)	**33***	**28**

* Façade correction -3dB

6.2 BS 4142:2014

BS 4142:2014 "Methods for rating and assessing industrial and commercial sound" presents a method for assessing the significance and possible adverse impact due to an industrial noise source, based on a comparison of the source noise levels and the background noise levels, both of which are measured or predicted at a noise sensitive receiver e.g. a residential property.

The specific noise level due to the source is determined, with a series of corrections for tonality, impulsivity, intermittency or other unusual characteristic. The rating level is then compared to the background noise level and the significance of the new noise source likelihood of any adverse impact is determined in accordance with the following advice:

"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occur. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

7. PROPOSED KITCHEN EXTRACTION SYSTEM AND ASSOCIATED NOISE LEVELS

It is proposed to install the following items of plant at the rear of the premises.

Table 7.0 Proposed Kitchen Extraction Fan Motor

External Plant Item	Make	Model	Reference Noise Level* $L_{w(A)}$
Kitchen Extract Fan Motor	Flakt Woods	40 MaXfan Compac	Outlet 88dB

*Reference sound power levels. Manufacturer's specifications are provided in Appendix B.

The ducting will be 400mm standard rectangular duct work. The extraction fan motor will be located internally and therefore only noise from the duct terminus has been considered.

In reference to section 6 of this report, no penalty addition has been applied for intermittency as when the source commences or ceases operation it will not attract the listeners attention within the dwelling. Penalty additions have not been applied for tonality as manufacturers' data shows no significant characteristics, or for impulsiveness as it is considered that these characteristics will not be perceptible sufficient to attract attention at the noise receptors. Penalty additions have not been applied for any other sound characteristics as mechanical plant of this type generally do not demonstrate such features.

7.1 Silencer

The extraction system will be fitted with an R02 - 3 - 1200 Acoustica silencer on the atmosphere side of the fan. The silencer provides the attenuation shown in Table 7.1. All silencers should be Melinex lined.

Table 7.1 Silencer Attenuation

63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
8	15	25	42	50	50	46	34

7.2 Directivity

A directivity correction should be applied as the extract fan duct aperture is to terminate approximately 90˚ to the nearest residential windows. A duct opening of 400mm has been used. The levels of attenuation (dB) at each octave frequency band (Hz) is provided in table 7.2 below.

Table 7.2 Directivity Attenuation

63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
0	0	2	5	7	12	16	18

7.3 Acoustic Louvre

The extraction system terminus will be fitted with a Wakefield Acoustics WA-ACL-300SB acoustic louvre. The louvre provides the attenuation shown in Table 7.3.

Table 7.3 Louvre Attenuation

63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
6	6	9	13	20	20	16	15

Corrections have also been applied for the attenuation from duct bends (1)*.

* Reference: Improving Ductwork, EU project, Brussls 1999. Also same as CIBSE.

8. NOISE IMPACT ASSESSMENT

This section presents calculations to predict the noise impact of the proposed kitchen extraction system, located at the site, at the nearest noise sensitive property.

8.1 Proposed Operational Hours and Background Noise Levels

The kitchen extraction system will operate during the opening hours of the proposed business. The opening hours are from 09:00 - 22:00 hours 7 days-a-week.

The lowest background noise level at the measurement position during the survey is **33dB** $L_{A90,1hour}$. The design range is **28dB** $L_{Aeq,T}$ at the façade of the nearest residential premises.

8.2 Nearest Noise Sensitive Properties

The nearest sensitive residential receptors were noted to be the first-floor windows located on the rear façade of 31 Coombe Road at an approximate distance of 2m from the flue terminus.

8.3 Description of Calculation Process

In accordance with the methodologies of BS 4142:2014, calculations have been undertaken to predict noise levels in which the kitchen extraction system could be operational at its maximum level. Given the distances between the noise sources and the noise sensitive receptors, point source calculations have been used.

8.4 Noise Level Predictions

Calculations to predict the noise of the kitchen extraction system operating at the facade of the residential property is given below. Full calculations are provided in Appendix D.

The rating noise level at the 1st floor window, with the mechanical plant operating, is predicted to be **28dB $L_{Aeq,T}$** which is **5dB(A) below** the lowest background noise level (33dB $L_{A90,1hour}$).

In accordance with BS 4142:2014 guidance, noise from the mechanical plant ***"is an indication of the specific sound source having a low impact"***. *The lower the rating level is relative to the measured background level, the less likely it is that the specific sound source will have an adverse impact.*

8.5 Vibration

In addition to the control of airborne noise transfer, it is important to consider the transfer of noise as vibration to adjacent properties as well as any sensitive areas of the same building. Vibration from the system is not expected, however, as a precaution plant should wherever possible be installed on suitable type isolators. The fan should be installed with flexible connections to adjacent structures.

Uncertainty

The levels of uncertainty in the data and calculations are considered to be low given the robust exercise undertaken in noise monitoring and the confidence in the data statistical analysis. Manufacturers' data for the plant is highly likely to be robust. Detailed calculations and resultant noise levels at the residential location are considered to be confidently predicted.

9. CONCLUSION

Sound Licensing has undertaken an environmental noise survey at the site in order to determine prevailing background noise levels that are representative of the nearest noise sensitive properties. The operation of the kitchen extraction system, in accordance with BS 4142:2014 guidance, indicates to creating a low impact. All worst-case scenarios have been applied to the assessment. The predicted operating noise level of the kitchen extraction system is demonstrated to comply with the London Borough of Kingston Upon Thames Council's policy.

APPENDIX A – Acoustic Terminology

Parameter	Description
Acoustic environment	Sound from all sound sources as modified by the environment
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far
Ambient sound level, La = LAeq,T	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T
Background sound level, LA90,T	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing ($20x10^{-6}$ Pascals).
Equivalent continuous A-weighted sound pressure level, LAeq,T	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time
Measurement time interval, Tm	Total time over which measurements are taken
Rating level, LAr,Tr	Specific sound level plus any adjustment for the characteristic features of the sound
Reference time interval, Tr	Specified interval over which the specific sound level is determined
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound
Residual sound level, Lr = LAeq,T	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T
Specific sound level, Ls = LAeq,Tr	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr
Specific sound source	Sound source being assessed

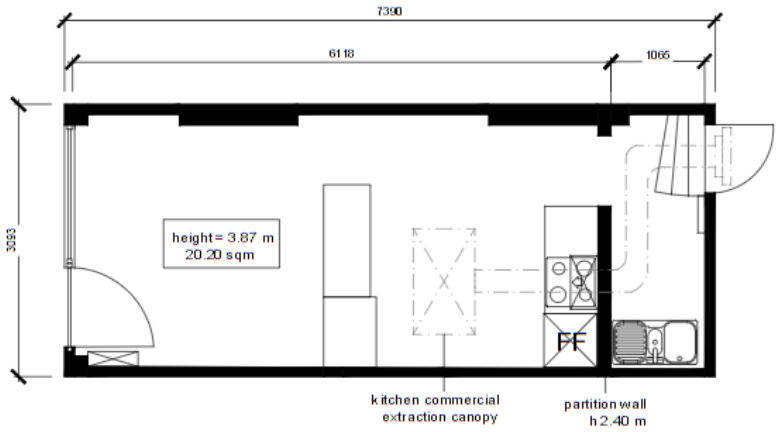
References:

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

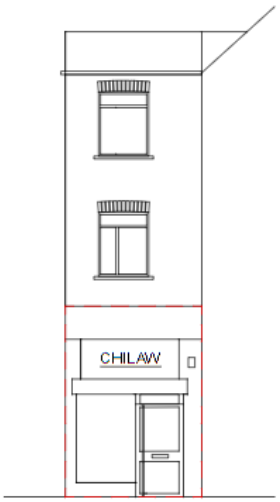
APPENDIX B – Data Sheets and Figures

Proposed Plans and Elevations

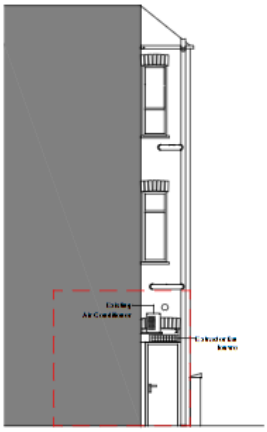
Legend:
change of use area



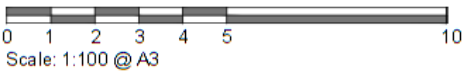
Proposed floor plan 1:50



Front elevation (south) 1:100



Rear elevation (north) 1:100



PROPOSED PLANS

Flakt Woods 40 MaXfan Compac Data Sheet

1

Woods
A FläktGroup Brand

HIGH PERFORMANCE CASED AXIAL
MAXFAN COMPAC

PRODUCT FACTS

- Volumes up to 4.9m³/s
- Static Pressures up to 900 Pa (Non-stalling characteristic)
- Fans tested to ISO5801 and BS848
- High efficiency energy saving IE2 motor
- Low breakout noise levels
- Motor protection and terminal block IP55 (DW172 & Defra Compliant)
- Ambient temperatures up to 80°C (dependent on size)
- Overheat protection as standard
- Compact robust light weight construction
- Galvanised casing for high corrosion resistance
- Full inverter control and flexibility

ELECTRICAL SUPPLY

230v/50Hz/1 Ph (3 Ph Motor) - L Type

TEMPERATURE RANGE

Suitable for temperatures up to 80°C*
*dependent on the fan size, please refer to the specific fan technical page.

SIZES

315, 355, 400, 450, 500, 560 and 630 mm

IMPELLERS

A unique high efficiency aerofoil section blade with a smoothed hub and clamp plate offers a high efficiency solution.

The Fläkt Woods impellers are all high pressure die cast to offer thin aerofoil sections for low generation of noise. Every cast aluminium component is X-ray examined using Real Time Radiography inspection prior to assembly. The maximum pitch angles shown allow for speed control by frequency inverter.

MOTORS

All motors are totally enclosed air stream rated with class F insulation. Constructed from aluminium or cast iron as standard with special pad mounted fixings. Although this product incorporates a three phase electric motor, by using a matched inverter solution it is suitable for use with a single phase electrical supply on site. In addition, using a frequency inverter allows the speed to be turned down to 20% of maximum speed. Suitable for horizontal or vertical shaft operation. Supplied IP55, with removable drain plugs.

Sealed for life bearings lubricated with wide temperature range grease. The complete range of motors are fitted with Thermistor DHP as standard. Motors are IE2 efficiency class as standard.

CASING

The MaXfan Compac is available with a galvanised casing, complete with an externally mounted pre-wired electrical terminal box. Casings are spun from sheet steel with integral pre-drilled and radiused inlet flanges. The galvanised finish gives a high resistance to corrosion and is ideal for external as well as internal use.

PRODUCT CODE

40 MaXfan Compac

- 40 - denotes the fan impeller diameter in centimetres

Flakt Woods 40 MaXfan Compac Acoustic Data

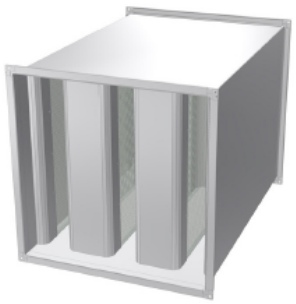
Fan Description	Ps Sound data at	Pa Static		Sound Spectrum (Hz)								Overall	
				63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3m**
31 MaXfan Compac	0.53 m3/s	252	Inlet*	81	79	80	82	80	76	71	66	88	63
31 MaXfan Compac	0.53 m3/s	252	Outlet*	83	80	81	82	80	77	72	67	89	64
31 MaXfan Compac	0.53 m3/s	252	Breakout*	73	68	64	66	61	53	51	47	75	45
35 MaXfan Compac	0.84 m3/s	302	Inlet*	82	80	84	83	80	77	73	69	89	65
35 MaXfan Compac	0.84 m3/s	302	Outlet*	83	80	85	84	81	78	74	69	90	65
35 MaXfan Compac	0.84 m3/s	302	Breakout*	74	68	68	67	60	54	53	51	76	47
40 MaXfan Compac	1.32 m3/s	200	Inlet*	75	76	82	79	78	77	74	70	86	63
40 MaXfan Compac	1.32 m3/s	200	Outlet*	77	77	85	80	79	77	75	71	88	64
40 MaXfan Compac	1.32 m3/s	200	Breakout*	67	62	65	59	53	48	50	48	70	40

R02 - 3 - 1200 Acoustica Silencer Data Sheet

R02
Rectangular Silencers

R02 - 3 - Attenuator

Available in seven standard lengths R02 3 Rectangular Duct Mounted Silencers have excellent attenuation properties, achieved with sound absorbing infill splitters, retained in the attenuator casing by a perforated liner. The resistance to airflow is a function of the face velocity and length. It is not recommended to select the R02 3 Silencers with a face velocity above 3.5 metres per second without asking advice regarding re-generated self noise. We can advise on the selections and can perform system analysis to ensure the correct unit is specified.



- High performance rectangular duct silencer
- Seven standard lengths
- Many connection options
- Cross section dimensions in 1mm increments
- System pressure within ducted systems to 1500 Pa
- Special lengths on request

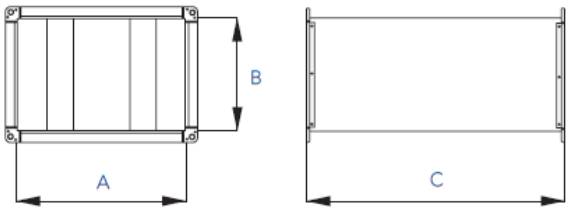
Insertion Loss (dB) - Centre Band Frequency

Product Code	Length (mm)	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
R02 - 3 - 600	600	6	9	13	25	31	32	24	20
R02 - 3 - 900	900	7	12	18	33	42	42	37	28
R02 - 3 - 1200	1200	8	15	25	42	50	50	46	34
R02 - 3 - 1500	1500	9	18	30	47	50	50	50	40
R02 - 3 - 1800	1800	10	20	35	49	50	50	50	52
R02 - 3 - 2100	2100	12	23	40	50	50	50	50	49
R02 - 3 - 2400	2400	13	26	40	50	50	50	50	50

Insertion loss data is derived from continual testing to BS4718 and other standards in independent UKAS certified laboratories, which includes where appropriate, re-generated or self noise testing in both forward and reverse flow conditions. If you request system analysis from our technicians all predictions will be assessed using the relevant certified insertion loss data together with relevant dynamic corrections.

Dimensional Data

Code	A Min	A Max	B Min	B Max	C Min	C Max
R02 - 3	100	1200	100	1200	400	2400



Resitance to Airflow (Pa)

Product Code	1.0m/s	1.5m/s	2.0m/s	2.5m/s	3.0m/s
R02 - 3 - 600	13	24	40	54	78
R02 - 3 - 900	14	26	41	55	81
R02 - 3 - 1200	15	27	42	56	86
R02 - 3 - 1500	15	27	44	56	88
R02 - 3 - 1800	16	28	44	57	90
R02 - 3 - 2100	16	29	45	59	92
R02 - 3 - 2400	16	30	47	62	95

Wakefield Acoustics WA-ACL-300SB Acoustic Louvre Data Sheet

Technical Data

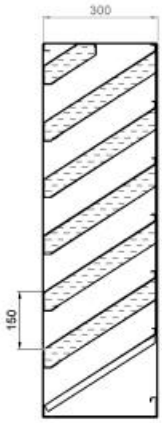
WAKEFIELDACOUSTICS
NOISE CONTROL TECHNOLOGY

Louvre Type WA-ACL-300SB

300mm deep single bank louvre

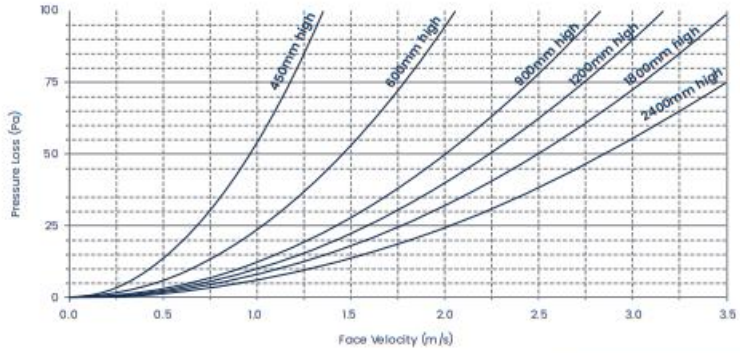
Specification: Single bank acoustic louvre 300mm deep, manufactured with horizontally mounted blades on a 150mm pitch, housed in an outer casing.

Louvre supplied with birdguard and polyester powder paint finish to a standard RAL / BS colour



Louvre			Sound Reduction (dB) at Octave Band Centre Frequency (Hz)							
Depth	**Style**	**Product Code**	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
300mm	Single Bank	WA-ACL-300SB	6	6	9	13	20	20	16	15

Pressure Loss Details



Pressure loss correction factors based upon installation conditions are given below:

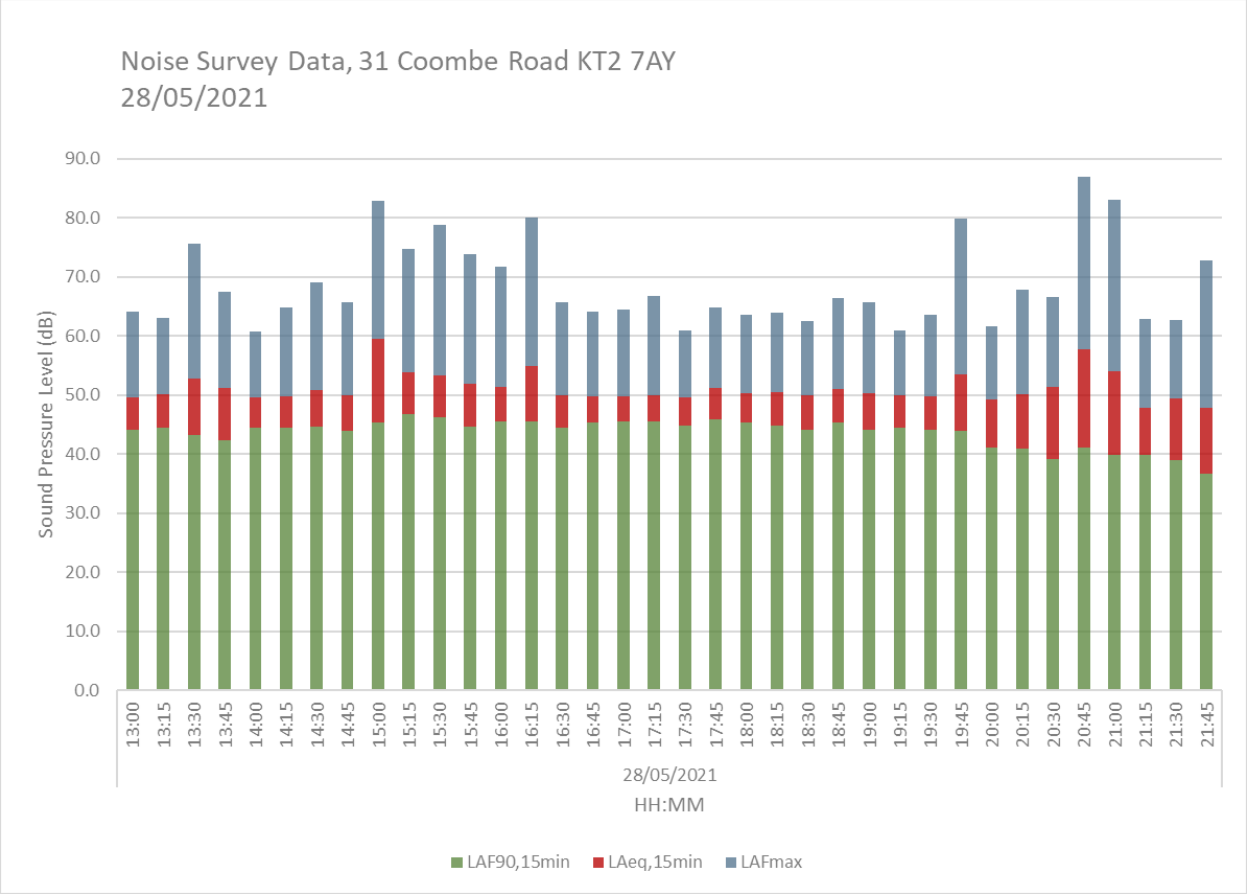
Fresh air intake, ducted to rear	+0%
Exhaust air to atmosphere, ducted to rear	+10%
Non-ducted	+50%

Weight	Height	Free Area
56kg/m2 Approx	450	33%
	600	38%
	900	42%
	1200	44%
	1500	46%
	1800	46%
	2100	46%
	2400	47%

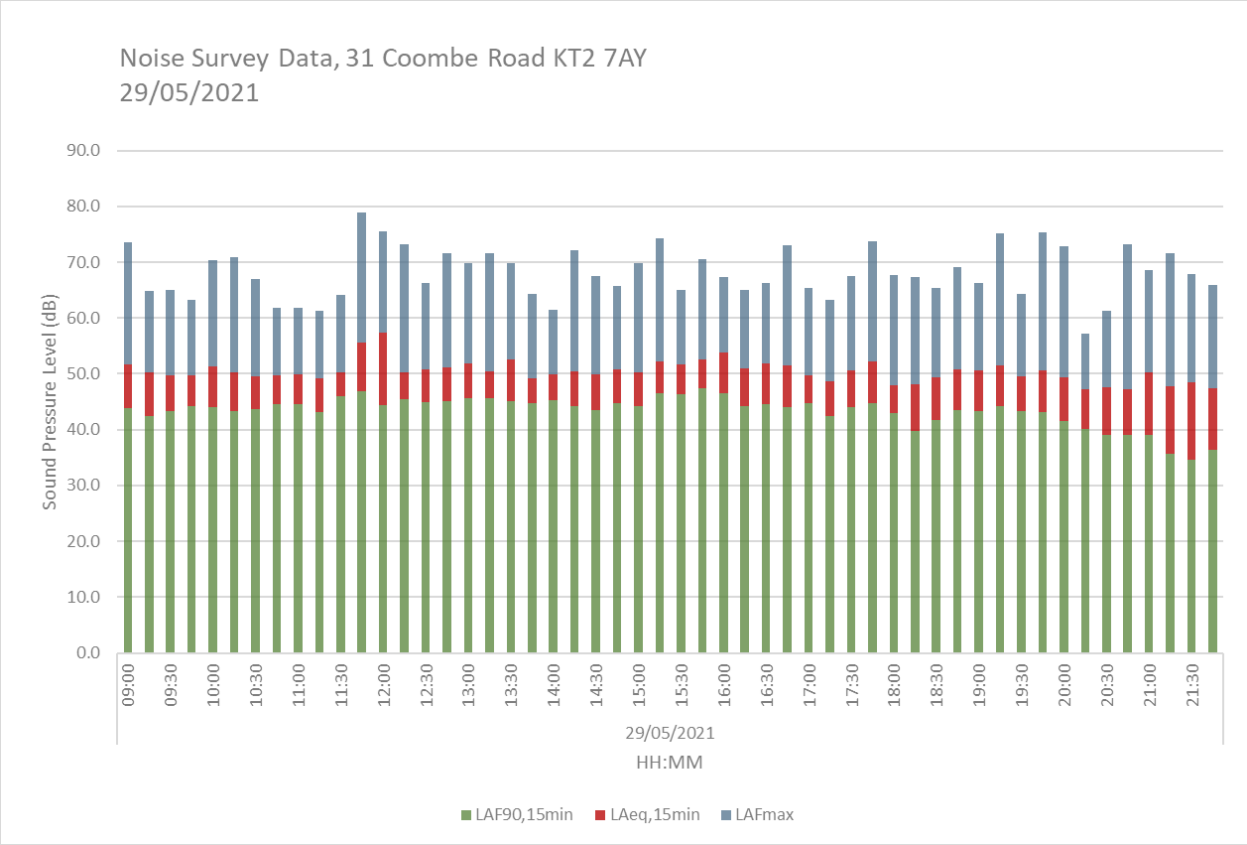
Options Available

- Birdguard (BG)
- Powder Coat finish (PC)
- Pre-coated steel (CS)
- Externally Flanged (F)
- Support Frame (SF)

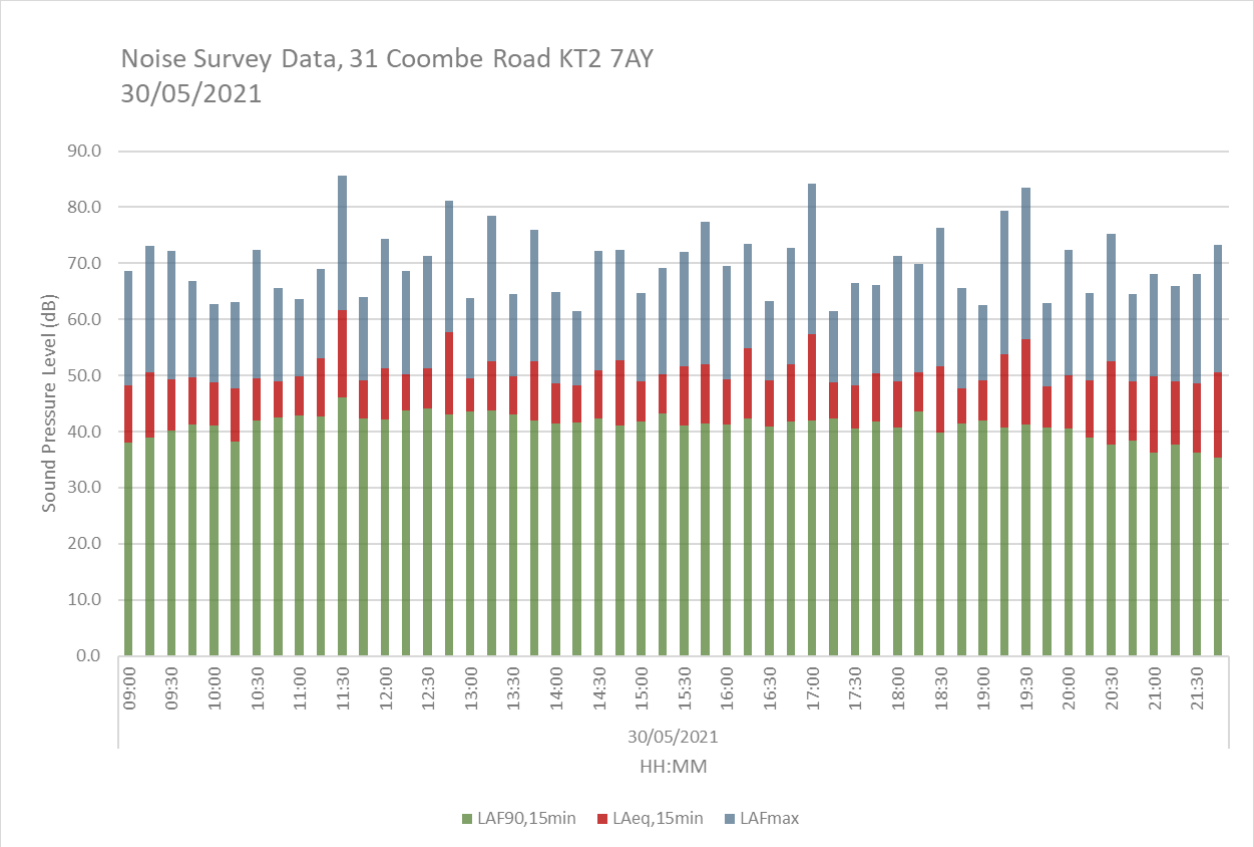
APPENDIX C – Noise monitoring Data



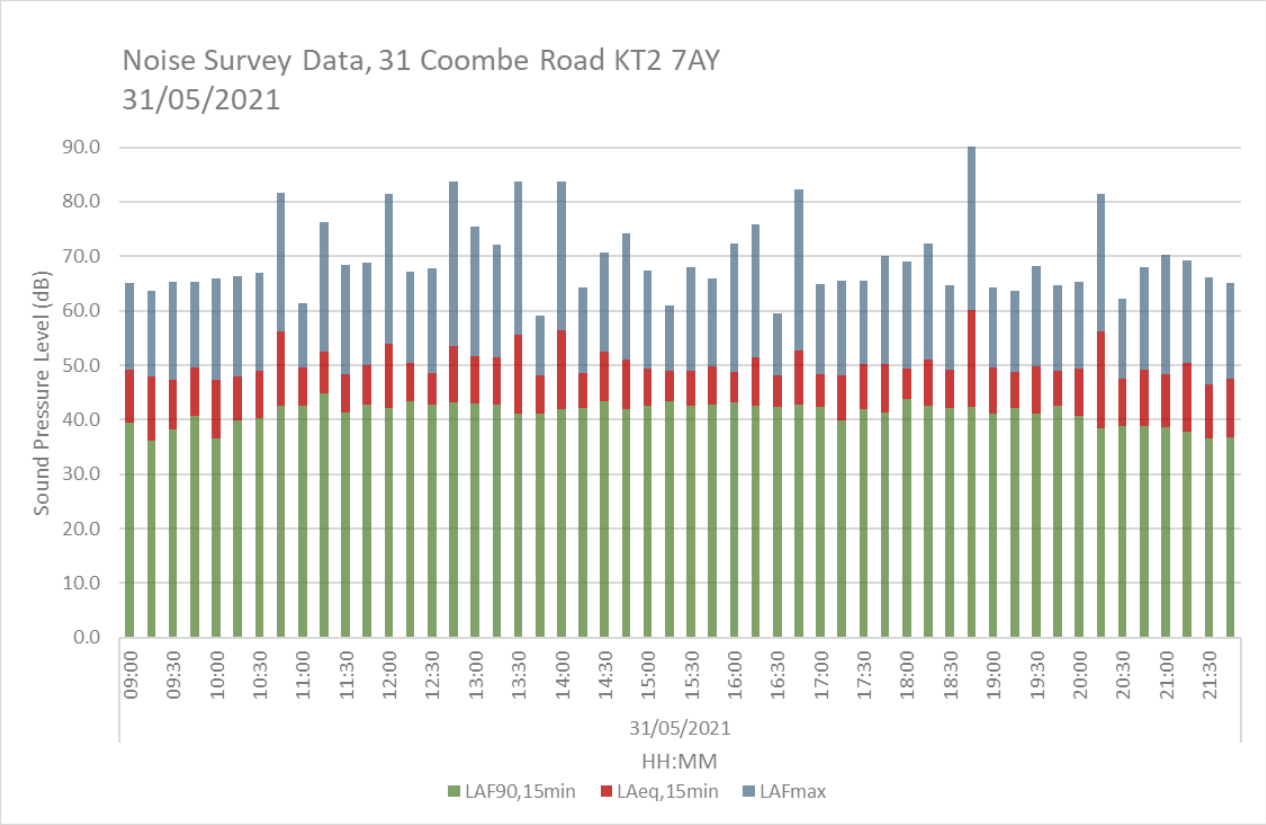
Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$	Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$
28/05/2021	13:00	49.7	64.1	44.1	51.1	43.6	28/05/2021	18:00	50.2	63.5	45.3	50.5	44.9
	13:15	50.1	63.1	44.4				18:15	50.6	63.9	44.8		
	13:30	52.8	75.6	43.3				18:30	50.0	62.5	44.1		
	13:45	51.1	67.5	42.4				18:45	51.1	66.4	45.3		
	14:00	49.6	60.8	44.4	50.1	44.4		19:00	50.3	65.7	44.2	51.2	44.2
	14:15	49.8	64.9	44.4				19:15	50.0	60.9	44.5		
	14:30	50.8	69.1	44.6				19:30	49.8	63.5	44.1		
	14:45	50.0	65.7	44.0				19:45	53.5	79.8	44.0		
	15:00	59.5	82.9	45.4	55.8	45.8		20:00	49.3	61.6	41.1	53.7	40.6
	15:15	53.9	74.7	46.7				20:15	50.2	67.7	40.9		
	15:30	53.3	78.8	46.3				20:30	51.4	66.5	39.2		
	15:45	51.8	73.8	44.7				20:45	57.8	87.0	41.1		
	16:00	51.3	71.8	45.5	52.0	45.2		21:00	54.1	83.1	39.9	50.6	39.1
	16:15	54.9	80.0	45.6				21:15	47.8	62.8	39.9		
	16:30	49.9	65.6	44.4				21:30	49.4	62.7	39.0		
	16:45	49.8	64.1	45.3				21:45	47.8	72.7	36.7		
	17:00	49.9	64.4	45.6	50.2	45.5							
	17:15	50.0	66.7	45.6									
	17:30	49.6	61.0	44.9									
	17:45	51.1	64.8	45.8									



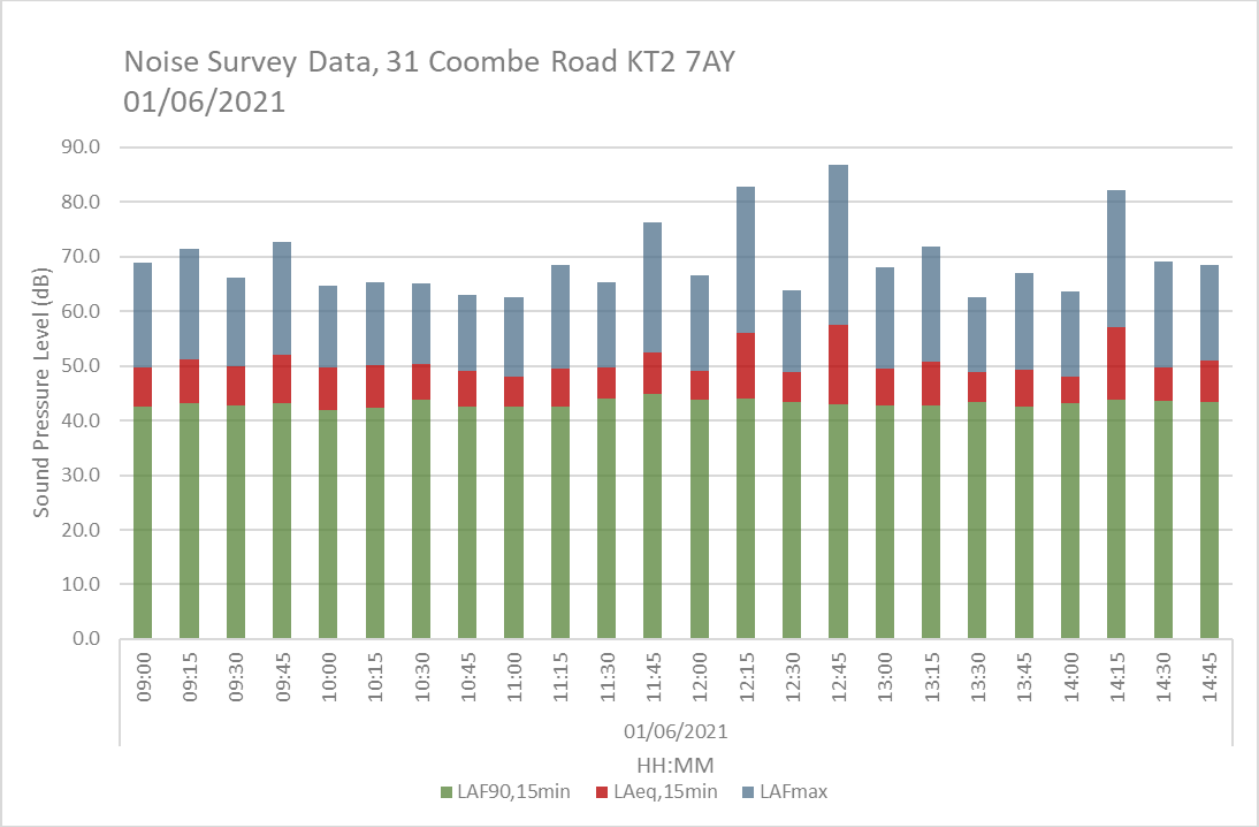
Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$	Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$
29/05/2021	09:00	51.7	73.7	43.8	50.4	43.5	29/05/2021	16:00	53.9	67.4	46.5	52.2	44.9
	09:15	50.3	64.8	42.5				16:15	51.0	65.0	44.2		
	09:30	49.7	65.0	43.3				16:30	51.9	66.3	44.5		
	09:45	49.8	63.2	44.3				16:45	51.5	73.1	44.1		
	10:00	51.3	70.4	44.1	50.3	43.9		17:00	49.7	65.5	44.7	50.5	44.1
	10:15	50.3	71.0	43.3				17:15	48.7	63.3	42.5		
	10:30	49.6	67.0	43.6				17:30	50.7	67.5	44.0		
	10:45	49.8	61.9	44.5				17:45	52.1	73.8	44.7		
	11:00	49.9	61.8	44.5	52.1	45.4		18:00	47.9	67.7	43.0	49.2	42.2
	11:15	49.2	61.3	43.2				18:15	48.2	67.4	39.7		
	11:30	50.3	64.2	46.0				18:30	49.4	65.5	41.8		
	11:45	55.6	79.0	46.9				18:45	50.8	69.1	43.5		
	12:00	57.4	75.5	44.4	53.5	45.0		19:00	50.6	66.2	43.4	50.6	43.6
	12:15	50.2	73.2	45.4				19:15	51.5	75.1	44.3		
	12:30	50.7	66.4	45.0				19:30	49.6	64.3	43.4		
	12:45	51.1	71.6	45.1				19:45	50.7	75.4	43.1		
	13:00	51.8	69.9	45.6	51.2	45.3		20:00	49.5	72.8	41.5	48.0	40.1
	13:15	50.4	71.5	45.7				20:15	47.3	57.1	40.2		
	13:30	52.6	69.8	45.1				20:30	47.5	61.4	39.1		
	13:45	49.2	64.3	44.8				20:45	47.2	73.2	39.0		
	14:00	49.9	61.5	45.2	50.3	44.5		21:00	50.2	68.5	39.0	48.6	36.7
	14:15	50.4	72.1	44.3				21:15	47.8	71.7	35.7		
	14:30	49.9	67.5	43.5				21:30	48.6	67.9	34.6		
	14:45	50.8	65.8	44.7				21:45	47.4	65.9	36.3		
	15:00	50.2	69.8	44.2	51.7	46.3							
	15:15	52.2	74.3	46.5									
	15:30	51.6	65.0	46.4									
	15:45	52.6	70.5	47.4									



Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$	Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$
30/05/2021	09:00	48.2	68.6	38.1	49.5	39.8	30/05/2021	16:00	49.4	69.5	41.2	52.0	41.6
	09:15	50.6	73.1	38.9				16:15	54.8	73.4	42.3		
	09:30	49.2	72.3	40.2				16:30	49.2	63.2	40.9		
	09:45	49.7	66.9	41.2				16:45	51.9	72.7	41.8		
	10:00	48.8	62.8	41.0	48.8	41.2		17:00	57.3	84.2	41.9	52.9	41.7
	10:15	47.7	63.1	38.2				17:15	48.8	61.5	42.4		
	10:30	49.4	72.4	42.0				17:30	48.2	66.4	40.6		
	10:45	48.9	65.6	42.5				17:45	50.3	66.1	41.8		
	11:00	49.9	63.6	42.9	56.6	43.8		18:00	49.0	71.3	40.7	49.9	41.6
	11:15	53.1	69.1	42.7				18:15	50.5	69.9	43.5		
	11:30	61.6	85.6	46.1				18:30	51.6	76.3	39.8		
	11:45	49.2	64.0	42.3				18:45	47.7	65.5	41.4		
	12:00	51.3	74.4	42.2	53.8	43.3		19:00	49.1	62.6	41.9	53.1	41.2
	12:15	50.2	68.6	43.7				19:15	53.7	79.3	40.8		
	12:30	51.3	71.3	44.1				19:30	56.4	83.5	41.3		
	12:45	57.8	81.2	43.1				19:45	48.1	62.9	40.8		
	13:00	49.5	63.7	43.6	51.3	43.1		20:00	49.9	72.5	40.5	50.4	39.0
	13:15	52.5	78.5	43.7				20:15	49.2	64.6	38.9		
	13:30	49.8	64.5	43.0				20:30	52.6	75.2	37.6		
	13:45	52.5	76.0	42.0				20:45	48.9	64.5	38.4		
	14:00	48.6	64.9	41.5	50.5	41.6		21:00	49.9	68.2	36.2	49.6	36.4
	14:15	48.1	61.5	41.6				21:15	49.0	66.0	37.6		
	14:30	50.9	72.2	42.3				21:30	48.6	68.0	36.2		
	14:45	52.7	72.3	41.1				21:45	50.5	73.4	35.4		
	15:00	48.9	64.8	41.8	50.8	42.0							
	15:15	50.2	69.1	43.3									
	15:30	51.6	72.1	41.0									
	15:45	51.9	77.5	41.5									



Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$	Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$
31/05/2021	09:00	49.2	65.2	39.5	48.6	39.0	31/05/2021	16:00	48.8	72.4	43.1	50.7	42.7
	09:15	47.9	63.8	36.1				16:15	51.5	75.8	42.5		
	09:30	47.4	65.3	38.2				16:30	48.2	59.5	42.4		
	09:45	49.6	65.3	40.8				16:45	52.7	82.2	42.8		
	10:00	47.3	65.9	36.6	51.9	40.3		17:00	48.3	64.9	42.4	49.4	41.5
	10:15	47.9	66.3	39.8				17:15	48.2	65.5	39.8		
	10:30	49.1	66.9	40.3				17:30	50.3	65.5	41.9		
	10:45	56.3	81.7	42.5				17:45	50.3	70.0	41.3		
	11:00	49.7	61.4	42.6	50.4	43.1		18:00	49.3	69.0	43.8	55.3	42.8
	11:15	52.5	76.2	44.8				18:15	51.1	72.4	42.6		
	11:30	48.4	68.4	41.4				18:30	49.2	64.7	42.2		
	11:45	50.0	68.7	42.7				18:45	60.2	90.8	42.3		
	12:00	54.0	81.5	42.2	52.1	42.9		19:00	49.7	64.2	41.1	49.3	41.8
	12:15	50.5	67.2	43.3				19:15	48.9	63.7	42.1		
	12:30	48.6	67.8	42.8				19:30	49.7	68.2	41.1		
	12:45	53.5	83.7	43.1				19:45	49.0	64.7	42.6		
	13:00	51.7	75.4	42.9	52.6	42.1		20:00	49.4	65.3	40.6	52.0	39.3
	13:15	51.5	72.0	42.7				20:15	56.1	81.5	38.5		
	13:30	55.6	83.6	41.2				20:30	47.5	62.2	38.8		
	13:45	48.2	59.0	41.2				20:45	49.1	68.1	38.9		
	14:00	56.5	83.7	42.0	53.1	42.4		21:00	48.4	70.3	38.6	48.5	37.5
	14:15	48.6	64.3	42.2				21:15	50.5	69.2	37.9		
	14:30	52.5	70.6	43.4				21:30	46.4	66.2	36.5		
	14:45	51.1	74.3	41.9				21:45	47.6	65.0	36.8		
	15:00	49.4	67.5	42.5	49.3	42.8							
	15:15	48.9	60.9	43.4									
	15:30	49.0	68.1	42.6									
	15:45	49.8	65.9	42.7									



Date	Time	$L_{Aeq,15min}$	L_{AFmax}	$L_{AF90,15min}$	$L_{Aeq,1hour}$	$L_{AF90,1hour}$
01/06/2021	09:00	49.7	69.0	42.5	50.8	42.9
	09:15	51.2	71.4	43.1		
	09:30	49.9	66.3	42.8		
	09:45	52.0	72.7	43.2		
	10:00	49.7	64.6	41.9	49.8	42.7
	10:15	50.0	65.3	42.3		
	10:30	50.3	65.2	43.8		
	10:45	49.1	63.0	42.5		
	11:00	48.0	62.5	42.6	50.2	43.6
	11:15	49.5	68.5	42.6		
	11:30	49.8	65.3	44.0		
	11:45	52.4	76.4	44.8		
	12:00	49.0	66.6	43.8	54.5	43.5
	12:15	56.0	82.9	44.1		
	12:30	49.0	63.9	43.3		
	12:45	57.5	86.9	42.9		
	13:00	49.5	68.1	42.8	49.7	42.9
	13:15	50.8	71.8	42.7		
	13:30	49.0	62.6	43.5		
	13:45	49.2	66.9	42.5		
	14:00	48.0	63.7	43.1	53.0	43.5
	14:15	57.1	82.1	43.9		
	14:30	49.7	69.0	43.7		
	14:45	51.0	68.6	43.3		

APPENDIX D – Calculations

Attenuation per double distance required = (6dB for LpA recommended)				6	dB			Metres	
					Enter Distance =			2	
	Frequency Hz								
	63	125	250	500	1000	2000	4000	8000	Total
	77	77	85	80	79	77	75	71	88.39
Total LW	77.0	77.0	85.0	80.0	79.0	77.0	75.0	71.0	88.39
'A' Weight	26.2	16.1	8.6	3.2	0	-1.2	-1	1.1	
LWA (Power)	50.8	60.9	76.4	76.8	79.0	78.2	76.0	69.9	84.59
LPA at New Dist'	36.80	46.90	62.40	62.80	65.00	64.20	62.00	55.90	70.59
SILENCER	8	15	25	42	50	50	46	34	
DUCT BENDS (1)	0	1	6	8	4	3	3	3	
LOUVRE	6	6	9	13	20	20	16	15	
DIRECTIVITY 90°	0	0	2	5	7	12	16	18	
LPA After Insert	**22.80**	**24.90**	**20.40**	**-5.20**	**-16.00**	**-20.80**	**-19.00**	**-14.10**	**27.85**

Sound Pressure Level @ Nearest Sensitive Receptor = 28dB $L_{Aeq,T}$