

Project:	172 Oxford Road Reading.RG1 7PL	Date:	30/10/2019
Client:	GMH Mo:Mo	Ref:	4533



Project:	172 Oxford Road Reading.RG1 7PL.		
Client:	GMH Mo:Mo		
Report Title:	Environmental Noise and mechanical plant assessment		
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1.0 Introduction

It is proposed that a new mechanical kitchen extraction system be installed as part of works to the commercial property known as 172 Oxford Road, Reading, RG1 7PL.

Paragon Acoustic Consultants Ltd has been commissioned to conduct an environmental noise survey to obtain statistical noise data to characterise the existing local background and ambient noise climate at the site and to derive noise limits to atmosphere based on Local Authority Noise Policy and other relevant guideline documents. This information is used to determine if the proposed new mechanical plant selections will meet with the derived noise limits and any noise mitigation measures that are considered necessary.

This practice has been verbally advised that the operational period of the proposed mechanical plant will be during daytime hours 10:00 – 23:00 only.

2.0 Site Description and Proposed Plant Location

2.1 Site Description

The site under consideration is situated at 172 Oxford Road, Reading, within the jurisdiction of Reading Borough Council.

The site under consideration is located at ground floor level within a terraced property at the address, with its frontage on the Oxford Road. Residential flats are located within the upper floors of the building. The fan for the new mechanical kitchen extraction system is proposed for location on the rear (north) façade of the building on the ground floor roof.

To the north of the site lies a small garden are presently overgrown with vegetation. Beyond the garden lie the rear gardens and facades of residential properties with their frontage on Cannon Street. To the east lie the adjoining terraced properties on the Oxford Road with a supermarket at ground floor level and residential above.

To the south of the site lies the Oxford Road and associated pavements, beyond which lie residential properties.

To the west lie the adjoining terraced properties on the Oxford Road with a barber shop at ground floor level and residential above.

The most exposed noise sensitive dwellings are those above the site, overlooking the proposed kitchen extract plant.

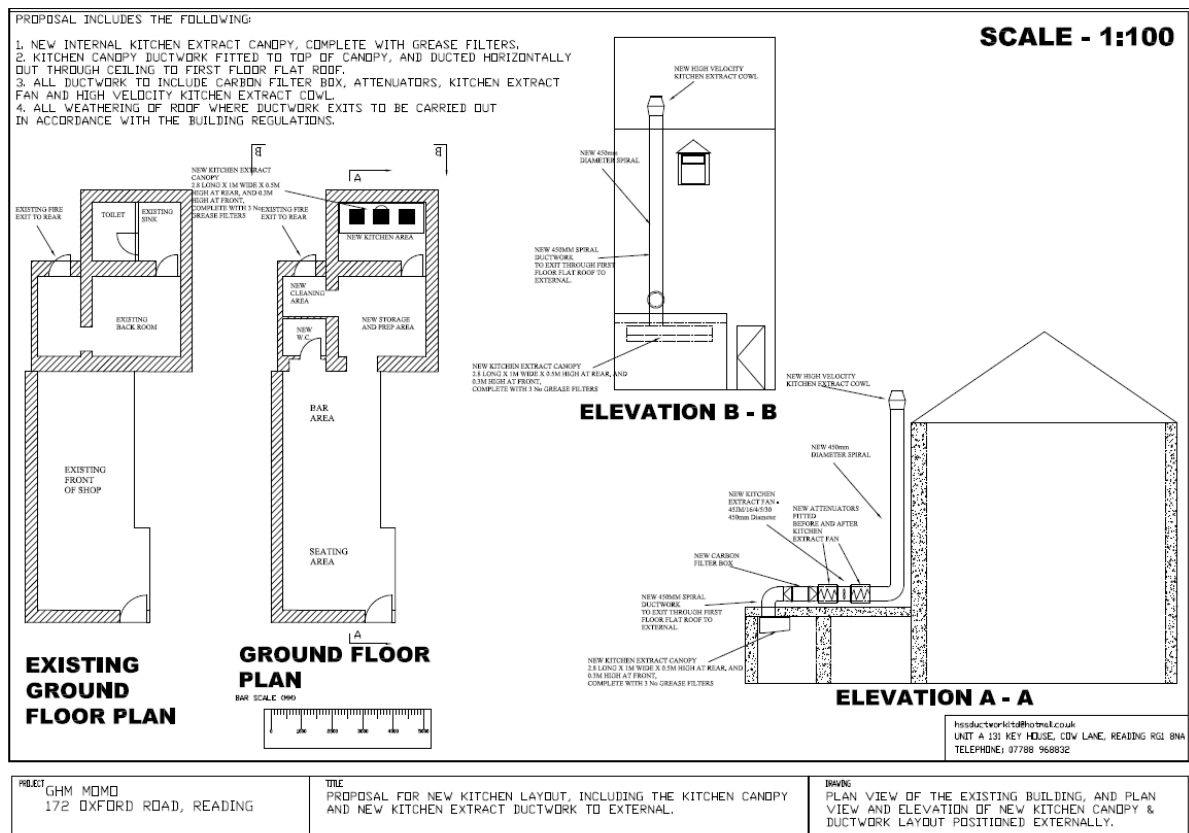
The site is illustrated by plan in Appendix A.

2.2 Proposed Plant Location

This practice has been provided with the following drawing indicating the extent of the proposed mechanical extraction system and its location.

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Figure 1: Proposed Plant Location



The drawing above does not explicitly show whether or not the proposed installation will incorporate flexible connections within the ductwork system. This requirement is indicated in Section 7.

3.0 Existing Noise Climate

The rear of the site is situated within a location that is shielded from major road vehicular traffic due to the surrounding buildings. Nonetheless, middle distance road traffic low frequency “rumble” and individual “event” type emissions were audible to the surveyor.

Aircraft over flights were observed sporadically during the manned survey at the start and end of the period. Their contribution to the background noise climate will have been included within the measurements taken.

Mechanical plant items were observed that were associated with third party properties. It is assumed that their contribution to the overall noise climate will have been included within the readings measured. It is taken that all mechanical plant associated with third party premises is operating within legal noise limits and has planning permission.

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4.0 Environmental Noise Survey

4.1 Measurements

The noise monitoring took place between the following dates / times:

- Start : 28/10/2019 at 10:59 hours
- End : 29/10/2019 at 10:44 hours

The noise monitoring was generally un-manned and was undertaken at the location as described below.

- **MP1:** At 2m above ground level at the rear of the site within the garden

The measurement location is illustrated on the site layout drawing in Appendix A.

Various statistical broad-band and spectral sound pressure level measurements were obtained during the survey. A measurement time interval $T_m = 15$ minutes was used for sampling. Measurements of the percentile level $L_{A90,T}$ were made using time weighting F as per clause 3.4 of BS 4142:2014.

The quantities recorded included:

- **L_{Aeq} :** the equivalent continuous A-weighted sound pressure level over the measurement period
- **L_{Amax} :** the maximum A-weighted sound pressure level for the measurement period
- **L_{A10} :** the A-weighted sound pressure level exceeded for 10% of the measurement period
- **L_{A90} :** the A-weighted sound pressure level exceeded for 90% of the measurement period

4.2 Weather during survey period

The weather conditions at the start of the manned period of the survey were dry and mild with a slight breeze. The weather conditions at the end of the survey were similar. The weather forecast did not indicate that precipitation was due.

4.3 Instrumentation

Sound pressure level measurements were obtained using the following instrumentation complying with the Type 1 specification of BS EN 60804, BS EN 60651, BS EN 60942, BS EN 61260, and BS EN 61672-1:

- Norsonic Type 118 Sound level analyser, serial number 31663
- Norsonic Type 1225 ½" microphone

The sound level analyser was mounted on a tripod set to provide a measurement height of 1.5 metres above ground level.

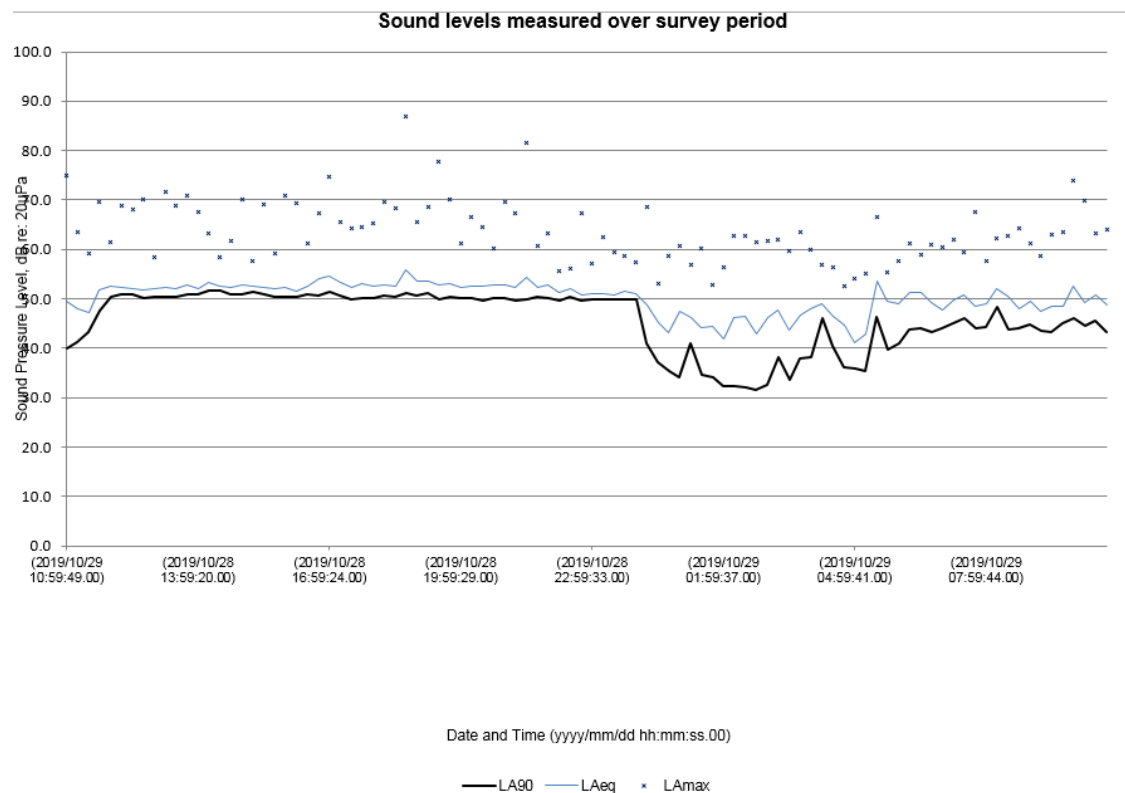
Calibration checks were made prior to and after completion of measurements using a Norsonic Type 1251 acoustical calibrator complying with Class 1 of BS EN 60942, calibration level 114.0 dB $\pm$ 0.3 dB, @ 1.0 kHz. All instrumentation carries a current manufacturer's certificate of conformance a copy of which is available upon request.

4.4 Background Sound Level - Results

The recorded survey data is shown within Appendix B. Broadband sound pressure level data over the survey period (L_{A90} background levels, L_{Aeq} and L_{Amax} measurements) are shown graphically below:

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Figure 2: Graphical Survey Data



It is considered likely that third party mechanical plant noise emissions dominated the noise climate from 11:59 hours on 28/10/2019 to 23:59 hours on 28/10/2019 as can be seen by the relatively “flat” results of L90 within the above graph. The lowest background sound level obtained for the proposed plant operational time of 10:00 – 23:00 hours is summarised below:

Table 1: Lowest background sound levels

Measurement Position	Lowest Background Sound Level Daytime
	10:00 – 23:00 L _{A90} , (15 min)
MP1 measurement position	43 dB

5.0 Evaluation of External Noise Criteria

Although the local vicinity contains properties of mixed usage, it is the residential dwellings which are considered to be the most exposed to potential noise emissions from the new plant.

5.1 Local Authority Noise Policy

In the absence of Local Authority advice regarding any individual requirements, this practice has considered the RBC paper headed “Local Plan Background Paper” “Information to support the Submission Draft Reading Borough Local Plan” dated March 2018. This paper includes the following details:

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4.26 Noise Generating Equipment (EN17)

4.26.1 Key Considerations

- The NPPF states that the planning system should prevent both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution (paragraph 109). Paragraph 123 further states that planning policies should avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development.
- A Noise Policy Statement for England was produced in 2010 by DEFRA, which contains the following vision:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

The NPSE aims are as follows:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.
- The Council receives numerous planning applications for the introduction of new noise generating industrial and commercial equipment such as air conditioning; refrigeration plant and kitchen extraction. This equipment is often installed in close proximity to residential properties and has the potential to cause significant annoyance and/or sleep disturbance to residents or other businesses, and have a negative impact on residential amenity.
- Planning applications for noisy mechanical plant are already required to be accompanied by a noise assessment which compares the noise level produced by the equipment against the existing background noise level using the British Standard 'Methods for rating and assessing industrial and commercial sound' (BS4142:2014). Whilst the BS4142:2014 method gives some guidance on assessing whether the level of noise may have an adverse impact, its recent update has made this guidance more ambiguous and crucially it does not set a noise limit for new plant.
- The Environmental Protection team for some years has required that the noise level from new mechanical plant be at least 10 dB below the background noise level in order to prevent 'background creep' (see draft policy for an explanation). However, this does not have the weight of policy behind it.
- Although general principles for noise were set out in policy CS34 of the Core Strategy (PP004), no specific noise levels are referenced in existing policy.

4.26.2 Policy Options

The following options have been considered and have been subject to Sustainability Appraisal. Where rejected, the reasons are summarised below.

• EN17(i) No policy – REJECTED

Whilst the Council would continue to usually seek the level set out in the proposed policy, without the benefit of policy it carries reduced weight. As such, it could lead to developments that have a detrimental effect on the quality of life and health of neighbours.

• EN17(ii) New policy limiting noise level to at least 10dBA below the existing background level – PROPOSED OPTION

This option would be a new policy, giving clarity to developers and applicants on the maximum level of background noise at the nearest sensitive receptor that will be acceptable. It will ensure that equipment does not have a detrimental effect on the health and quality of life of neighbours.

Based on the details of this document it does appear as though RBC will be continuing to require that the noise level from new mechanical plant be at least 10 dB below the background noise level. As such, the assessment shall consider this limit.

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5.2 External Noise Criteria Proposed

The derived external noise criteria which the new building services plant shall be required to achieve are shown below:

Table 2: Limiting Noise Criteria applicable at the affected premises

Plant Location	Receptor	Daytime plant operational period proposed of 10:00 – 23:00 hours $L_{Aeq,(15\text{ min})}$
As given in Section 2.2 herein	Noise Sensitive Developments ^[3]	33 dB ^[1]

[1] Note: The limiting noise levels are deemed to be considered at a position 1 metre outside the nearest affected premises.

6.0 Review of Proposed Plant

6.1 Introduction

The new kitchen extract fan will comprise a 45 JM/16/4/5/30/ 1 phase long case axial fan.

Detailed calculations have been carried out in order to determine the likely level of airborne noise transmission outside the identified assessment locations due to the operation of the proposed new plant to be installed.

Section 2.2 details the plant location/s used in the assessment.

The following sections provide a record of the proposed new plant, the operational sound levels used as the basis for this assessment, and a specification for noise mitigation treatments.

6.2 Plant Noise Data

The noise levels / acoustic data for the proposed new plant items are shown below:

Figure 3: Noise data for proposed Kitchen Extract fan

	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3 m**
Inlet*	75	74	70	68	64	63	59	55	79	50
Outlet*	76	74	70	68	64	63	60	56	79	50
Breakout*	66	56	48	45	39	35	38	32	67	28

* Lw dB re 10⁻¹² W

** dBA re 2x10⁻⁵ Pa

Performance data has been derived from tests carried out in a Flakt Woods laboratory, in accordance with ISO 5801 and is specifically applicable for Ducted installations. When an electronic controller is incorporated, enhanced motor noise can occur - particularly when the operating speed is well below maximum. FWL therefore recommend using an auto transformer speed controller for noise sensitive applications.

—|—

The drawing indicate that the proposed installation will include roomside and atmosphere side attenuators. From the information provided the following claimed insertion loss performance has been advised:

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Table 3: Client proposed roomside and atmosphere side attenuator performance

Quantity	1/1 octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Minimum insertion loss (dB re: 2x10 ⁻⁵ Pa)	2	4	6	10	14	10	7	8

The performance indicated in Table 3 represents the proposed attenuators as manufactured by Messrs Northern Fan Supplies LTD 450mm dia x 450mm long without a pod. The atmosphere attenuator shall be changed for an attenuator of a higher acoustic performance as given in Section 7 herein.

6.3 Predicted Plant Noise Levels

Calculations have been carried out using the data presented earlier within this report to predict the resultant sound pressure levels due to airborne transmitted noise outside the nearest exposed noise assessment position, and corresponding to the quietest period of plant operation.

For an installation such as the proposed extract fan there are a number of airborne noise paths to be considered such as:

- Noise breakout from the fan casing
- Noise breakout from the connecting ductwork
- Noise transmission from the duct discharge opening to atmosphere
- Discharge duct re-generated noise levels (see Section 7.5 of this report)

Using standard calculation techniques the fan noise transmission from these paths (excluding point d)) have been assessed, and the combined predicted results are summarised in Table 4 as follows.

The predicted results for the proposed situation are summarised below:

Table 4: Predicted Noise Levels at nearest affected premises

Plant under consideration	Worst case assessment location	Approx. distance to receiver	Direct line of sight?	Predicted Lp
Kitchen Extract ventilation system	Residential properties overlooking the ground floor roof of the site	2m from fan to facade	yes	53 dB

Predictions are based on the plant operating normally at the noise levels detailed herein.

The Local Authority require that the applicants ensure that the noise rating level was at least 10dB below the existing background level (L_{A90}) as measured at the nearest noise sensitive receptor. As such, the proposed scheme does not meet with the noise requirements set out by the Local Authority and it is considered that additional noise mitigation measures will be required in order to further reduce noise levels.

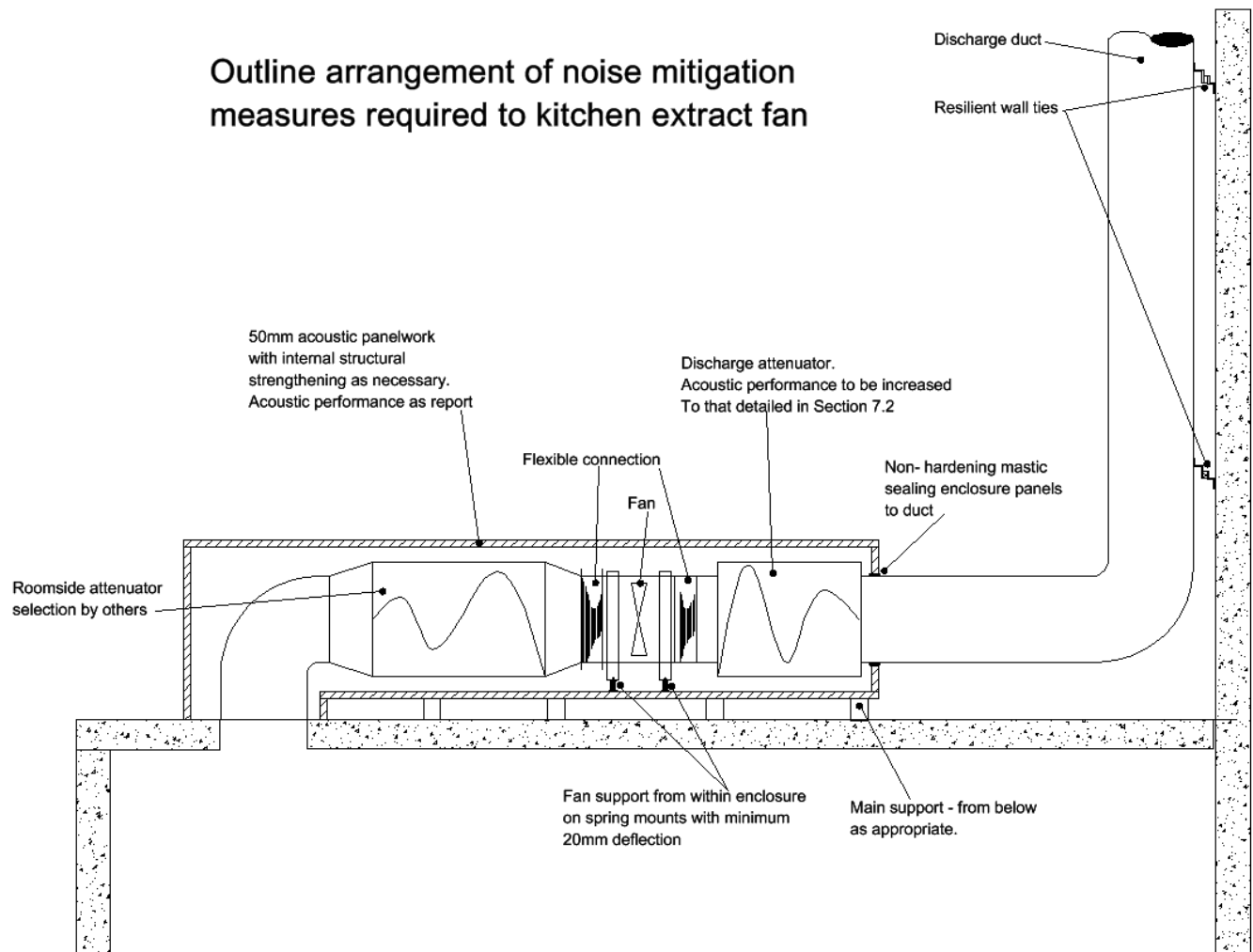
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7.0 Outline Noise Mitigation measures

Based on the findings of the initial assessment, it is considered necessary to provide noise mitigation measures to the proposed scheme. The following sections provide outline details of the noise mitigation scheme.

7.1 Outline Scheme

Figure 4: Outline noise mitigation scheme – sectional view not to scale.



NB: It is understood that the fan motor is an in-airstream type and is not bifurcated. If a bifurcated fan is to be used the enclosure will require specific design to allow airflow to the motor for air cooling purposes. The final fan type shall be advised to the enclosure supplier for their designs of any motor cooling measures required.

Minimum 2mm rubber flexible connections shall be located between the fan and adjacent ductwork.

NB: The atmosphere side attenuator/s must be housed within the acoustic enclosure

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7.2 Extract Fan Discharge (exhaust to atmosphere) Attenuator

The atmosphere side attenuator (i.e. on the extract fan discharge, exhaust to atmosphere) shall be changed to an attenuator providing the following acoustic performance:

Table 5: Requirement for enhanced atmosphere side attenuator performance

Quantity	1/1 octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Minimum insertion loss (dB re: 2x10 ⁻⁵ Pa)	7	12	24	25	25	25	20	15

It is considered that in order to achieve the stated performance, a rectangular attenuator selection will be required. The attenuator shall be enclosed in its entirety by the proposed acoustic enclosure given in Section 7.3.

Others shall determine if the roomside attenuator reduces fan noise to reasonable internal noise levels. If required, others shall enhance the roomside attenuator acoustic performance as necessary.

The dimensions of the attenuator shall be determined by a suitable attenuator supplier, in conjunction with any other physical and aerodynamic performance constraints imposed by the client and the ventilation system designer.

The attenuator shall be selected to ensure that the installed pressure loss does not exceed 25Pa at the maximum design duty. Alternatively, should the system designer require a lower installed pressure loss for the atmosphere side attenuator, then the lower pressure loss limit shall be complied with.

A constructional specification for the attenuator is provided as follows:

Attenuator dimensions to be determined by the hardware supplier.

Attenuator construction:

Casings: Galvanised steel construction in accordance with DW144 pressure ratings and leakage requirements, with casing gauge, flange connections and intermediate stiffeners to suit.

If rectangular attenuators proposed: Acoustic elements (Rectangular attenuators): Each element constructed from a minimum 0.8mm galvanised steel sheet folded to form a continuous peripheral tray for retaining perforated galvanised steel facings. The acoustic medium shall be Class 1 rated (as per BS476: Part 7) mineral wool of 35kg/m³ minimum density, and retained behind the 30% minimum free area perforated steel in order to prevent fibre migration. Where it is predicted or known that the airstream will contain a grease laden atmosphere or high moisture atmosphere the mineral wool shall be bagged within Melinex and retained behind the 30% minimum free area perforated steel.

The elements shall incorporate aerodynamically shaped leading edges and be secured within the casing using suitable mechanical fixings. Side elements shall be provided to reduce noise breakout

If circular attenuators proposed: The acoustic medium shall be Class 1 rated (as per BS476: Part 7) mineral wool of 35kg/m³ minimum density, and retained behind the 30% minimum free area perforated steel in order to prevent fibre migration. Where it is predicted or known that the airstream will contain a grease laden atmosphere or high moisture atmosphere the mineral wool shall be bagged within Melinex and retained behind the 30% minimum free area perforated steel.

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7.3 Acoustic Panels Forming Enclosure to System

A six sided (four sides, top and base) enclosure shall be formed using 50mm acoustic panel work as follows:

The enclosure shall be formed by 50 mm thick acoustic panels comprising of a minimum 20gauge sheet steel outer, 50mm mineral wool of minimum density 30kg/m³ faced with fibre glass tissue and a perforated sheet steel inner of minimum free area 33%. The panels shall be suitably stiffened to allow for structural loadings. The colour of the powder paint shall be agreed with the architect prior to the manufacture of panels. Access doors shall be designed by others and shall be designed such that the acoustic performance detailed below is not undermined.

The enclosure shall provide an imperforate structure and shall achieve the following insertion loss:

Table 6: Requirement for fan enclosure acoustic performance

Quantity	1/1 octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Minimum insertion loss (dB re: 2x10 ⁻⁵ Pa)	11	18	23	28	27	27	26	25

7.4 Fan and Ductwork Support Vibration Isolation Mounts

The following specification provides details of vibration isolation equipment to be used.

Table 7: Requirement for vibration isolation equipment

Position	Mounting type (See following description)	Minimum mount deflection (mm)
Fan supporting mounts	SH	20
Ductwork / attenuator supporting mounts	RM	3
All mountings /bases – refer to general specification Clause 1.1.0		
OS: OPEN SPRING MOUNTINGS See Clause 1.2		
RM: RUBBER TURRET MOUNTINGS See Clause 1.5		

SPECIFICATION CLAUSES FOR VIBRATION ISOLATION DEVICES

1.1.0 GENERAL

1.1.1 All vibration isolators should be selected to provide the minimum static deflection required. Selection should allow for asymmetric load distributions such that the minimum static deflection can be achieved on all vibration isolators under normal operating conditions.

1.1.2 All vibration isolators must be suitable for the loading, operating and environmental conditions which will prevail. Special attention shall be paid to vibration isolators that will be exposed to atmospheric conditions and appropriate finishes must be applied to prevent excessive rusting or corrosion.

1.1.3 All vibration isolators shall be color coded or otherwise clearly marked to indicate rated load and deflection capacity to facilitate identification during installation and service.

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1.1.4 The efficiency of an isolator system can be seriously impaired if the system is connected to rigid pipes, electrical conduits, ducts or shafts. It is essential that such external connections be as flexible as possible not only to prevent transmission of vibration through the connections and allow the system freedom of movement but also to avoid possible failure of the connections.

1.1.5 The vibration isolator system should be selected to support the operating weight of the plant and equipment to be isolated only. All associated pipework, valves, filters, ductwork etc. and their contents must be supported independently so as not to impose additional forces on the isolator system and all flexible connections must be selected and arranged to accommodate this requirement.

1.1.6 Where it is proposed to support AHU/enclosed fan units on vibration isolators, it is recommended that flexible connections are fitted to any external connecting ductwork, pipework, conduits etc. regardless of whether or not the internal fan and motor assembly is supported on vibration isolators and has internal flexible connections to the unit casings.

1.2 OPEN SPRING MOUNTINGS WITH HEIGHT ADJUSTMENT (TYPE OS)

1.2.1 Each mounting shall consist of a helical steel spring as the principal isolation element and shall incorporate a built-in leveling device.

1.2.2 The spring will be permanently fixed under both free and working conditions to fabricated top and bottom plates. The method of fixing the spring to the top and bottom plates shall incorporate high frequency attenuation devices preventing direct contact between spring and end plates. Therefore fixing by loose location metal clips or welding will NOT be permitted.

1.2.3 Each helical steel spring shall be permanently color coded to denote rated load and deflection capacity and, by design, to have an outside diameter at least equivalent to 85% of its working height with a minimum 50% overload capacity before becoming coil bound.

1.2.4 A 6mm thick ribbed Neoprene pad shall be bonded to the underside of the bottom plate except where bolting to flat steel surfaces is required.

1.5 NATURAL RUBBER TURRET MOUNTINGS (TYPE RM)

1.5.1 Each mounting shall be moulded in durable oil resistant Natural Rubber with integral steel base and upper fixing boss. The Natural Rubber shall be color coded to denote rated load and deflection capacity.

1.5.2 Each mounting shall be supplied with a standard fitting bolt or optional height adjuster as required.

7.5 Discharge Duct Termination

It is recommended that the discharge velocity be lowered to reduce the possibility of excessive flow generated noise. The current proposal also includes for a cowl above the discharge opening. This arrangement may potentially give rise to excessive flow generated noise levels.

It is not considered possible to accurately predict the flow generated noise from such an arrangement. It is therefore recommended that the velocity of the discharge be decreased as far as practically possible (typically less than 6m/s) in order to reduce the risk of excessive flow generated noise.

It is important that the system is designed such that obstructions are not introduced that may cause turbulence and increase flow generated noise. It is assumed that the client will verify that the reduction in air velocity will remain compatible with any legal requirements and any requirements of the Local Authority in respect of odour (& moisture etc) dissipation.

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7.6 Noise Mitigation – General

Paragon Acoustic Consultants has considered the acoustic performance of the enclosure. The introduction of this type of structure has implications in other areas of design. As such, the client shall employ the services of other specialists to take responsibility for other areas of design associated with the introduction of such a structure. The following list is provided as an example of other areas to be considered as a minimum:

- **Structural:** A suitably qualified consultant shall assess all structural loading as necessary. All support steelwork to be considered by others.
- **Aesthetics:** The visual appearance of the enclosure is to be agreed by the client's architect. The architect shall also consider all necessary statutory approvals and address design issues not covered by the relevant specialist consultant.
- **Alteration to existing services:** The installation of each acoustic hardware may require alteration to certain of the existing mechanical and electrical services in the vicinity of the proposed hardware. The client shall co-ordinate any such works.
- **Delivery and installation access:** The enclosure supplier shall make appropriate arrangements for the delivery and installation of hardware, including equipment such as cranes and scaffolding requirements.
- **Guarantees:** The client shall obtain the necessary guarantees that the acoustic hardware (enclosure and attenuators) will meet the minimum insertion loss requirements as specified by this practice in the foregoing section. In addition, the client shall obtain all other guarantees as required.
- **Maintenance / repair / replacement:** The enclosure shall allow for the maintenance / repair / replacement of the extract fan system as required.
- **Warranties:** The client shall ensure that the warranties provided by the fan supplier/manufacture are not invalidated by the introduction of the noise mitigation works.
- **Submission of final designs:** The final design of the noise mitigation (and associated ventilation system) shall be submitted to Paragon Acoustic Consultants for comment prior to manufacture.

Paragon Acoustic Consultants can offer details of a local acoustic company that would be able to assist with the supply of acoustic hardware, as follows:

Caice Acoustic Air Movement Ltd

Riverside House
3 Winnersh Fields
Gazelle Close
Winnersh
Berkshire
RG41 5QS

Telephone Number: 0118 918 6470

Contact: Andy Smith

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8.0 Predicted Fan System Noise Levels following mitigation

Calculations have been carried out to predict the noise levels at the nearest exposed noise assessment positions including the insertion loss effect of the noise mitigation indicated In Section 7. Example calculation analysis sheets to the most exposed residential and commercial receivers are included in Appendix C for reference. The predicted results are summarised below:

Table 8: Predicted Noise Levels (with mitigation) at nearest affected premises

Plant under consideration	Worst case assessment location	Approx. distance to receiver to fan	Direct line of sight?	Predicted Lp dB LAeq	Derived noise limit Lp dB LAeq
Kitchen Extract ventilation system	Residential properties overlooking the ground floor roof of the site	2m from fan to facade	Yes	33 dB	33 dB

Predictions are based on the plant operating normally at the noise levels detailed herein,

For noise sensitive residential properties, the predicted noise level due to the mitigated plant operation is assessed in accordance with BS4142:2014 in the following section of this report.

9.0 Conclusions

A background noise survey has been undertaken to determine the noise climate likely to exist at noise sensitive properties at the rear of 172 Oxford Road, Reading, RG1 7PL, where the positioning of a mechanical kitchen extraction system is proposed.

Noise emissions of the kitchen extract system have been determined where possible and extrapolated to the receiver positions using standard acoustic calculation techniques. Based on the predicted kitchen extract fan noise levels at the receiver positions an assessment has been undertaken.

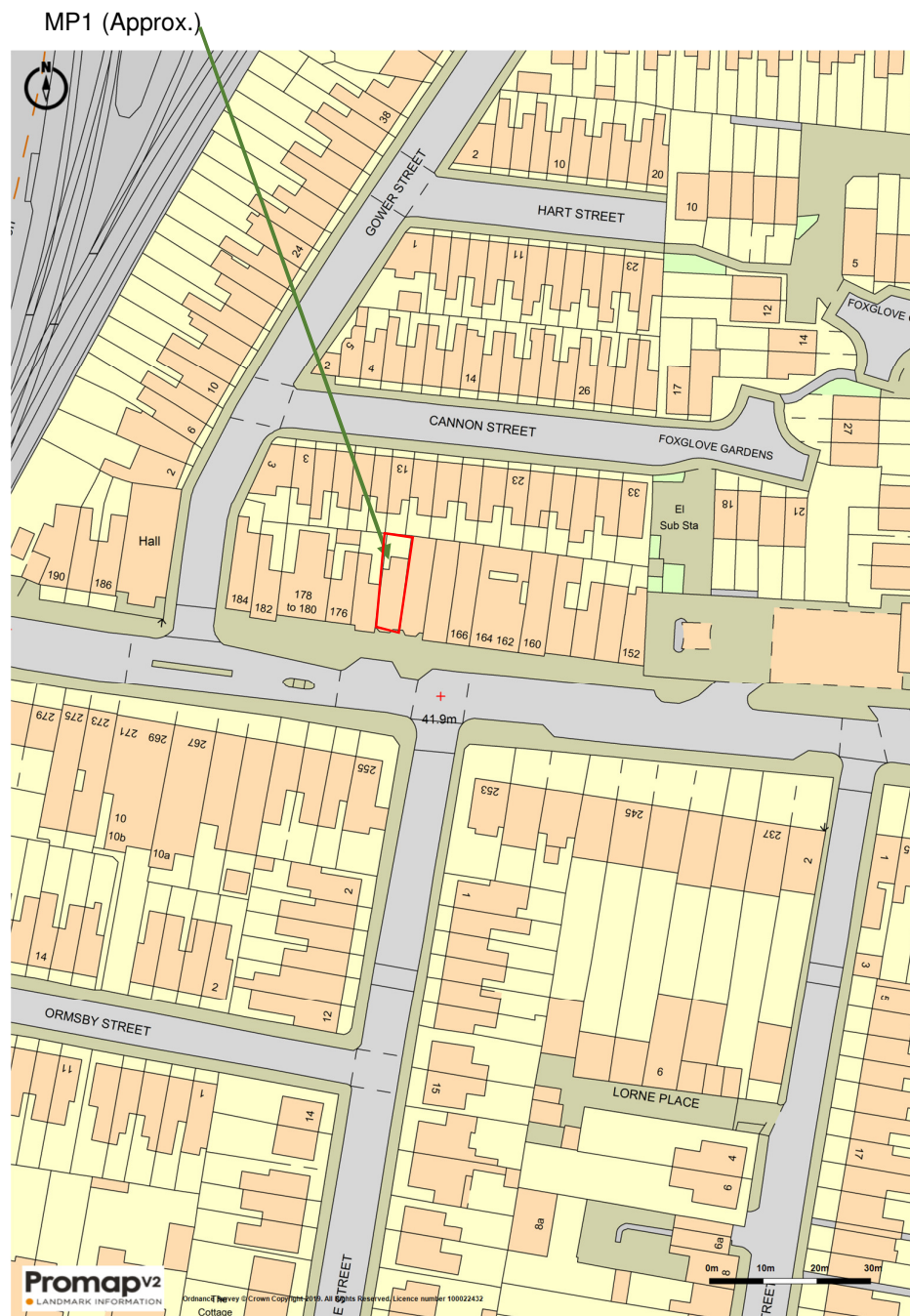
The assessment shows the proposed scheme does not meet with the noise requirements set out by the Local Authority and therefore outline noise mitigation measures have been advised.

Subsequent analysis of the system noise emissions based on the noise mitigation measures detailed in Section 7.0 show that the scheme will meet with the noise requirements set out by the Local Authority.

Following implementation and achievement of the noise mitigation recommended it is predicted that its noise emissions will meet the existing noise policy operated by Reading Borough Council. On this basis, reservations are not expected from the planning authority on the grounds of noise.

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Client:	GMH Mo:Mo	Ref:	4533

Appendix A: Site Plan



Project:	172 Oxford Road Reading.RG1 7PL	Date:	30/10/2019
Client:	GMH Mo:Mo	Ref:	4533

Appendix C: Calculation sheets

project	172 Oxford Road								
date	31/10/2019								
Plant	Proposed kitchen extract ventilation system								
Frequency	63	125	250	500	1000	2000	4000	8000	dB(A)
Fan Casing breakout									
Fan radiated sound power level	66	56	48	45	39	35	38	32	48
directivity (Q-factor)	6	6	6	6	6	6	6	6	
enter distance to the receiver	1								
correction for distance to receiver	-11	-11	-11	-11	-11	-11	-11	-11	
number of units	1								
correction for the number of units	0	0	0	0	0	0	0	0	
Barrier loss	0	0	0	0	0	0	0	0	
Other effects (reflections near receiver)	3	3	3	3	3	3	3	3	
predicted noise level at receiver	64	54	46	43	37	33	36	30	46
Duct breakout									
Fan in-duct discharge sound power level	76	74	70	68	64	63	60	56	71
Breakout via 600mm dia x 1000long circ duct (att)	-26	-26	-26	-26	-26	-26	-26	-26	
Correction for inlet side Lw (additional source)	3	3	3	3	3	3	3	3	
Breakout Lw	53	51	47	45	41	40	37	33	48
directivity	6	6	6	6	6	6	6	6	
enter distance to the receiver	0.5								
correction for distance to receiver	-5	-5	-5	-5	-5	-5	-5	-5	
number of units	1								
correction for the number of units	0	0	0	0	0	0	0	0	
Barrier loss	0	0	0	0	0	0	0	0	
Other effects (reflections near receiver)	3	3	3	3	3	3	3	3	
predicted noise level at receiver	57	55	51	49	45	44	41	37	52
TOTAL CALCULATED B/O LP AT RECEIVER	65	58	52	50	46	44	42	38	53
TOTAL CALCULATED DISCH LP AT RECEIVER	44	43	34	25	18	17	16	15	31
TOTAL Lp calculated at the receiver =	65	58	52	50	46	44	42	38	53
Fan Casing breakout									
Unattenuated fan case noise at receiver predicted	64	54	46	43	37	33	36	30	
enclosure insertion loss	11	18	23	28	27	27	26	25	
LP at receiver following enclosure	53	36	23	15	10	6	10	5	28
Duct breakout									
Predicted noise level at the receiver unattenuated	57	55	51	49	45	44	41	37	52
Attenuator insertion loss	7	12	24	25	25	25	20	15	30
Resultant after attenuator	50	43	27	24	20	19	21	22	32
Mitigated noise predictions									
Fan Casing breakout	53	36	23	15	10	6	10	5	28
Duct breakout	50	43	27	24	20	19	21	22	
combined lp	55	44	28	25	20	19	21	22	33