



BRAIDEN ACOUSTICS LTD

Innovation Forum // 51 Frederick Road // Salford // Manchester // M6 6FP

NOISE IMPACT ASSESSMENT

Prepared For : NADA Architects

Date : 4 Aug 2022

Site : 169 Kingsway, Burnage

Report No. : 10990revB

1 INTRODUCTION

Braiden Acoustics has been commissioned by NADA Architects to undertake an acoustic survey at the site of 169 Kingsway, Burnage in order to discharge a noise condition relating to planning application 130116/FO/2021 which proposes:

Conversion of second floor to additional 1 bed flat with associated rear dormer extension.

Condition 4 states:

4) a) Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Kingsway and the ground floor commercial premises shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The approved noise insulation scheme shall be completed before any of the dwelling units are occupied.

Noise survey data must include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The following noise criteria will be required to be achieved:

- *Bedrooms (night time - 23.00 - 07.00) 30 dB LAeq (individual noise events shall not exceed 45 dB LAmax,F by more than 15 times)*
- *Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq*
- *Gardens and terraces (daytime) 55 dB LAeq*

b) Prior to first occupation of the residential units, a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the internal noise criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the internal noise criteria.

Reason - To secure a reduction in noise from traffic or other sources in order to protect future residents from noise disturbance, pursuant to Policy DM1 in the Manchester Core Strategy and Policy DC26.

The above condition is in two parts:

- a) initial noise survey
- b) post completion verification survey.

The first part of the condition will be addressed by this report. The latter part of the condition can only be performed once the works have been completed.

Since the original report in January 2022, comments from the EHO have been received:

Condition 4 (acoustic insulation)

This condition cannot yet be discharged. The acoustic report submitted is sufficient however several noise reduction measures are recommended within the report and these must be implemented. A further report is required for the proposed whole house ventilation system, this must be submitted once the system is confirmed along with the verification report.

This report includes details of the proposed ventilation scheme, along with a noise assessment of the scheme.

The verification report is a separate assessment that can only be undertaken once the works have been completed.

1.1 AIM

This is a revised report from the original document in January 2022, where an alternative ventilation system will be presented and assessed for noise. All other aspects of the original report will be repeated so this is a standalone document.

2 DESCRIPTION OF SITE

The site is currently an office at ground floor and residential flat at first floor.



Figure 1
Street view of site

2.1 SITE LOCATION AND NEIGHBOURING USES

The site is bounded by Kingsway (A56) to the west. On either side of the property, at ground floor level, there is a barbers and a TV repair shop. There is also a plumber's merchant in the row of shops, on the corner of Kingsway and Grangethorpe Drive. The rear of the property backs on to the rear of residential properties of Burnside Drive.





Figure 2
Site location and surrounding uses

There is the Styal Line railway line some 80m to the west, which serves Manchester Piccadilly and Manchester Airport.

Further to the east are residential dwellings.

2.2 PROPOSED USE

It is proposed to erect an additional one-bedroom apartment within the loft space, with a dormer at the rear to create a bedroom.

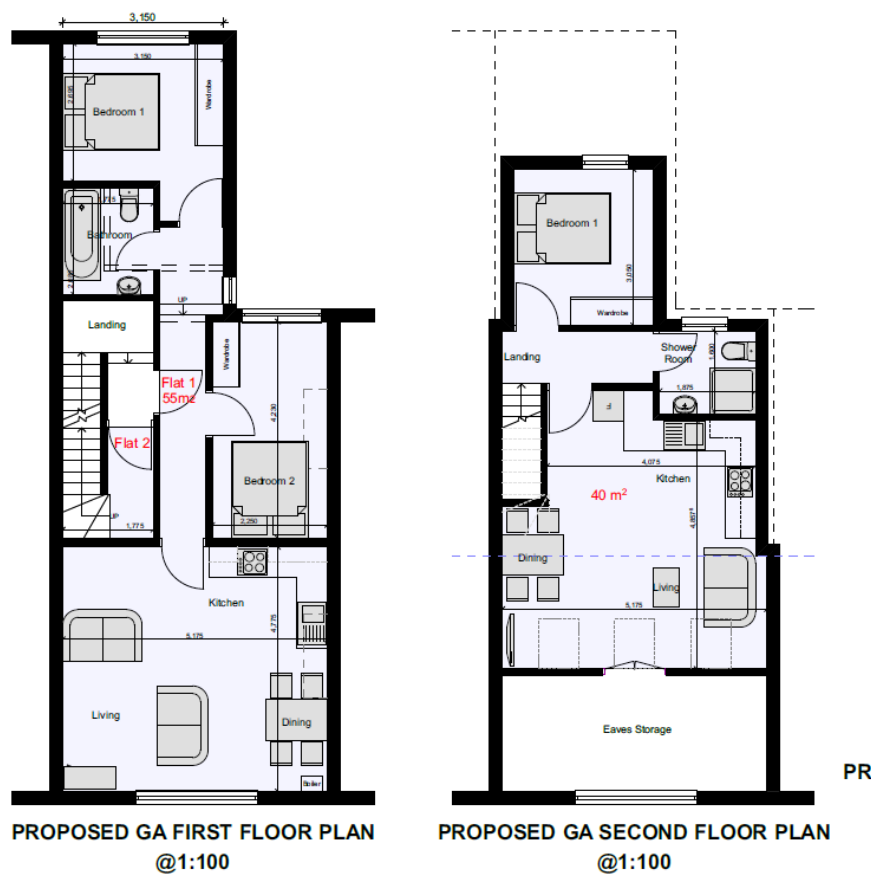


Figure 3
Site layout

2.2.1 Alternative ventilation system

It is proposed to install a MVHR (mechanical ventilation heat recovery) system, as shown in Figure 4.





Figure 4
Proposed layout of whole house ventilation

The MVHR units will be the Vent Axia Lo-Carbon Sentinel Kinetic BH.



Figure 5
Vent Axia MVHR Unit

The units can come with additional acoustic solutions

- Acoustic top box – reduces duct noise
- Acoustic enclosure – reduces breakout noise from unit



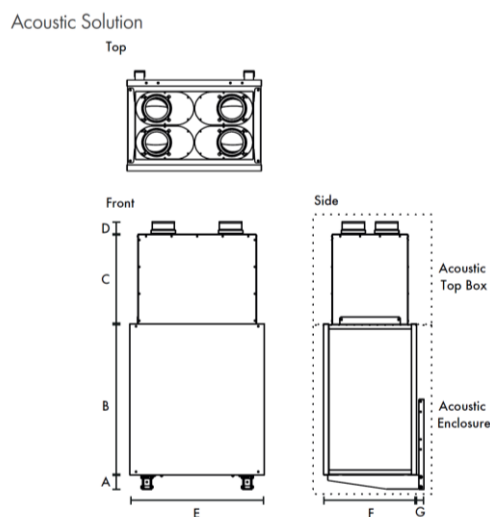


Figure 6
Acoustic Solution for MVHR unit

With the Acoustic Solution (top box and enclosure), the noise levels are as follows:

		Octave band, Hz, dB SWL								SPL dB(A)	
Speed	Test mode	63	125	250	500	1k	2k	4k	8k	LwA	@ 3m
20%	Supply	57.1	44.6	36.4	27.9	20.6	14.8	18.1	23.8	35.2	17.7
	Extract	54.4	40.1	29.6	22.2	17.5	14.5	17.8	23.5	31.1	13.6
	Breakout	37.5	33.8	29.1	22.9	17.0	14.0	17.8	23.6	27.7	7.2
40%	Supply	64.9	56.3	46.4	36.1	28.2	15.4	18.1	23.8	44.6	27.1
	Extract	60.2	46.8	35.7	28.2	21.9	14.8	18.1	23.7	36.6	19.1
	Breakout	46.0	43.6	36.3	30.4	23.9	15.9	18.1	23.6	33.5	13.0
60%	Supply	72.3	63.0	55.6	43.1	34.1	19.5	18.6	24.0	51.9	34.4
	Extract	61.4	53.3	43.4	34.7	27.2	15.5	18.1	23.8	41.4	23.9
	Breakout	52.2	50.5	44.4	38.2	33.5	23.8	19.3	23.8	41.0	20.5
80%	Supply	73.8	67.9	61.6	50.0	38.6	23.4	20.2	25.2	56.8	39.3
	Extract	68.6	58.2	50.5	40.5	31.1	17.2	18.2	23.9	47.5	30.0
	Breakout	65.6	55.5	50.5	43.8	39.7	32.7	24.9	24.0	47.4	26.9
100%	Supply	77.3	70.8	64.9	53.8	41.4	26.3	21.9	26.8	60.1	42.6
	Extract	71.5	60.6	53.5	43.9	33.4	19.1	18.5	24.0	50.5	33.0
	Breakout	69.0	58.4	53.4	47.1	43.0	37.5	29.9	24.9	51.1	30.6

Figure 7
MVHR noise levels

3 ACOUSTIC CRITERIA AND METHODOLOGY

This is a residential development that may be susceptible to environmental noise, such as road traffic noise and/or noise from local industry. Recommended noise levels due to environmental noise are taken from BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” [1] which, in turn, takes guidance from the research based World Health Organisation “Guidelines for Community Noise”. Where necessary, mitigation measures have been recommended so that the noise level thresholds are not breached.

Noise levels are usually given separately for the night-time – 2300-0700 hrs and day time – 0700-2300 hrs.

3.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

The National Planning Policy Framework is the current document for planning guidance. Paragraph 123 of the NPPF says that planning decisions should aim to:



- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum, other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Unfortunately, the NPPF supersedes the previous planning guidance for noise, PPG 24, which is much more descriptive regarding noise assessments and limits; hence, PPG 24 is sometimes still used to assess a site, with relation to noise, by some Councils.

3.2 BS 8233: 2014

The British Standard BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” gives guidance on recommended indoor ambient noise levels for residential dwellings.

Room	Criterion	$L_{Aeq,T}$	
		night	day
Bedroom	Sleeping	30	35
Dining Room/Area	Dining	--	40
Living Room	Resting	--	35

Table 1

Recommending indoor ambient noise level thresholds from anonymous noise (taken from Table 4, BS 8233:2014)

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

Internal noise levels in habitable rooms are calculated using either the simple or rigorous method as described in Annex G in BS 8233:2014.

3.2.1 Noise levels in external living areas

For external living areas such as gardens and balconies, BS 8233:2014 § 7.7.3.2 recommends an upper limit of 55dB $L_{Aeq,day}$ although there is a caveat:

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

3.2.2 Maximum noise levels

In the 2014 edition of the Standard, the criterion of 45dB L_{AFMax} inside bedrooms has been removed although there is Note 4:



NOTE 4 regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,P}$ depending on the character and number of events per night. Sporadic noise events could require separate values.

The use of the phrases ‘may be set’ and ‘could require’ imply that this is a discretionary criterion.

The L_{Amax} criterion is used where the level is not exceeded more than 10 times during the night time period.

3.3 BS 4142

BS 4142:1999 “Method for rating industrial noise affecting mixed residential and industrial areas” [2] assesses industrial noise with regards to nearby residential dwellings. The guidance is commonly used to compare the equivalent noise from an industrial source only (specific noise level), L_{Aeq} , to the background noise level, L_{A90} , at the nearest sensitive receptor (NSR).

When measuring the Background Noise Level, the Standard states:

Choose outdoor measurement locations that will give results that are representative of the ambient sound and residual sound at the assessment location(s). Make the measurement of the ambient sound level, the residual sound level and the background sound level at a height of 1.2 m to 1.5 m above the ground, unless there is a specific reason to use an alternative height (which should be justified), and under similar conditions, e.g. similar influence of reflections and measurement height above the ground. Where practical, minimize the influence of reflections by making the measurements at least 3.5 m from any reflecting surface other than the ground.

Where it is necessary to undertake measurements above ground floor level, choose a location which is approximately 1 m from the facade on the relevant floor of the building if it is not practical to make the measurements at least 3.5 m from the facade at this elevation. NOTE When measurements for distant sources are made at 1 m from a facade, the measured level can be adjusted to an equivalent free-field level by subtracting a 3 dB correction factor. For sources that are relatively close or not perpendicular to the facade the correction may be 1 dB or 2 dB, in which case the reasons for not using a correction of 3 dB ought to be explained.

Essentially, background noise measurement should be made free field. If measurements are made at the façade then a correction should be made in order to represent the free field.

This Standard has been recently updated, BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” [3]. Whereas the old standard added 5dB ‘penalty’ to the Specific Noise Level (SNL) if the noise source has a ‘character’ that can draw attention that may be described as tonal, intermittent or impulsive, the new standard gives clearer guidance on noise ‘character’. Furthermore, the previous Standard gave only one 5 dB penalty whereas the new Standard may not. When added to the specific noise level it forms the rating level. The new Standard gives the guidance for the following types of noise character:

Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.

NOTE 1 The prominence of tonal or impulsive sound from a source can be masked by residual sound. In many cases the amount of masking varies as the residual sound changes in level and possibly character. The source’s tonal and/or impulsive characteristics could also vary with time.

Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention.

Tonality



For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Once a penalty for noise character is added to the Specific Noise Level then this is termed the Rating Level.

The background level is then compared to the rating level. It is usual that the rating level due to the source should be below the background noise level at the nearest sensitive receptor; indeed BS 4142 states:

“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.”

3.4 ACOUSTICS VENTILATION & OVERHEATING GUIDE

Internal noise from mechanical ventilation systems is discussed in Section 3 of the Acoustics, Ventilation & Overheating Guide (AVO). Noise levels are essentially based on those internal noise levels given in BS 8233 (Table 1). The allowable internal noise levels from mechanical ventilation systems originate in Approved Document F and then reproduced in Table 3-4 in AVO.



Ventilation condition	Possible system or design solution	Desirable internal ambient noise levels from mechanical services
ADF – Whole Dwelling Ventilation	System 3: Continuous mechanical extract (MEV), minimum low ventilation rates System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum low ventilation rates	Bedrooms $\leq L_{Aeq} 26$ or 30 dB [Note 1] Living Rooms $\leq L_{Aeq} 30$ dB
ADF – Extract Ventilation	System 1: Intermittent extract fans System 3: Continuous mechanical extract (MEV), minimum high ventilation rates System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum high ventilation rates	Bedrooms $\leq L_{Aeq} 26$ or 30 dB Living / Dining Rooms $\leq L_{Aeq} 35$ dB Bathroom / WC / Kitchen $\leq L_{Aeq} 45$ dB
ADF – Purge Ventilation	Manually controlled fan exchanging a minimum 4 air changes per hour	No desirable noise levels are currently proposed based on the lack of evidence of acceptable noise levels when providing purge ventilation for the purpose of rapidly diluting indoor pollutants.

Note 1 A lower level may be more appropriate;.

Figure 8

Indoor ambient noise levels from mechanical services - ADF ventilation condition (taken from Table 3-4 in AVO)

For MVHR systems with *minimum ventilation rates* (background ventilation) the noise levels in habitable rooms should typically not exceed 30 dB.

Sometimes it may be necessary to use the ‘boost’ function of the ventilation system, for example, in the overheating condition. This will, inevitably, require rapid movement of air, which is provided by higher fan speeds and consequently higher noise levels. The allowable noise levels for the overheating condition are given in Table 3-5 in AVO.

Possible system or design solution	Desirable upper internal ambient noise levels from mechanical services
Ventilative cooling or Comfort cooling	Bedrooms $L_{Aeq} 30 (\pm 5)$ dB Living / Dining Rooms $L_{Aeq} 35 (\pm 5)$ dB

Table 2

Indoor ambient noise levels from mechanical services - Overheating condition

So, for the overheating condition, noise levels cannot exceed the following:

- 35 dB in Bedroom
- 40 dB in Living Rooms

3.5 COUNCIL CRITERIA

The Council have guidance for noise criteria and assessment methodologies that are described in their planning document [4]. It states:

The guidance aims to provide help and advice in relation to noise in a planning context to encourage good acoustic design. It outlines what is expected in relation to current guidance and policy with the aspiration that new developments achieve the highest possible standards without compromising the health and well-being of people that live and work within the City of Manchester.

3.5.1 Residential Developments

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Section 3.6.1.1 of the Council's guidance states:

Manchester City Council has adopted the following internal noise limits for residential properties:

- **Bedrooms**
 - **30 dB LAeq (night time - 23.00 - 07.00)**
 - **45 dB LAmax,F (individual noise events should not normally exceed by more than 15 times)**
- **Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq**
- **Gardens and terraces (daytime - 07.00 - 23.00) 55 dB LAeq**

3.5.2 Noise and Vibration from Fixed Plant / Equipment

Section 3.6.1.5.1 of the Council's planning guidance states:

Any noise assessment needs to consider not only the overall level of noise emitted but also its particular characteristics. The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate that:

'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location'.

By designing the sound pressure level of any plant items to generate a noise impact of at least 5dB below the existing background level, any plant noise impact should be of a negligible level which should not give rise to complaints from users or occupiers of existing noise-sensitive usages.

4 MONITORING DETAILS

4.1 MONITORING OVERVIEW

Personnel: John Braiden, BSc & MSc Acoustics, MIOA.

Equipment: NTi XL2 integrated real time analyser & B&K 4231 calibrator.

Weather 4- 8degC, <5m/s wind, 80-100% cloud

The sound level meter was calibrated before after the measurements with no drift reported.

Monitoring was unmanned.

Noise measurements were made at one location. Background noise (L_{A90}), 'average' noise levels (L_{Aeq}) and maximum noise levels (L_{Amax}) were taken in 15 minute intervals.

4.1.1 Monitoring times

Noise monitoring started at 21:00 Thu 09/12/2021 and continued for 24 hours

4.1.2 Monitoring location

The microphone was one metre from the first floor windows facing onto Kingsway, as shown by the arrow in Figure 2.



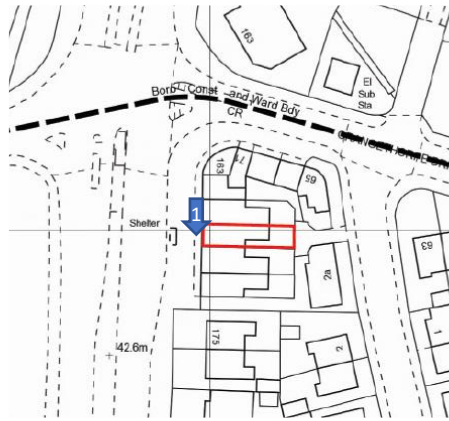
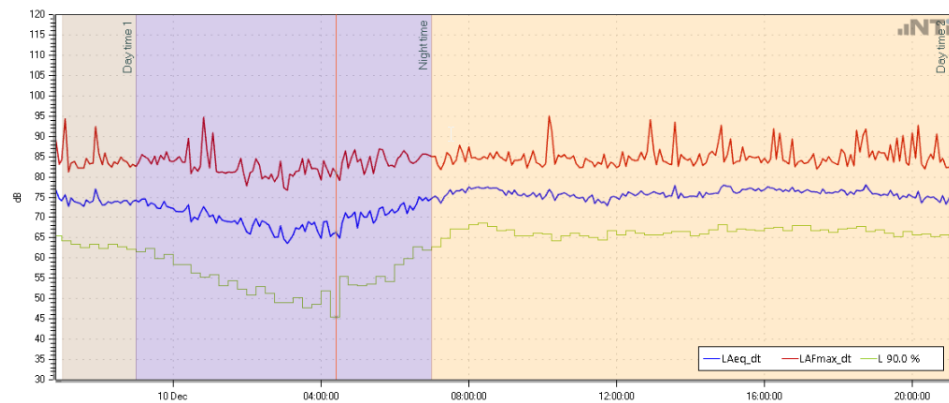


Figure 9
Site location showing monitoring position

4.2 MONITORING RESULTS



Cursor: Position=2021-12-10 04:25:00 LAeq_dt=66.3 dB LAFmax_dt=80.9 dB L 90.0 %=45.4 dB

Figure 10
Time history

The predominant noise source was, unsurprisingly, road traffic noise from Kingsway.

Day	Time		Duration	Time Period	L _{A90} dB	L _{Aeq} dB	L _{Amax} dB
	Start	Finish					
Thurs	21::00	23:00	02:00	day	63	74.1	
1	23:00	07:00	08:00	night	53	70.8	86 ¹
	07:00	21:00	14:00	day	66.3	76	87.2

Table 3
Summary of noise monitoring results –

As Kingsway is a four lane arterial route in/out of Manchester, then noise levels were typically high.

The overall free field² noise levels are as follows:

¹ the night max level not exceed more than 15 times.

² a 3 dB correction was made for façade monitoring.



$L_{Aeq}(\text{night}) \quad 71 - 3 = 68 \text{ dB(A)}$
 $L_{Amax, <15}(\text{night}) \quad 86 - 3 = 83 \text{ dB(A)}$
 $L_{Aeq}(\text{day}) \quad 76 - 3 = 73 \text{ dB(A)}$
 The quietest L_{A90} was 45.4 dB.

5 ACOUSTIC ASSESSMENT

5.1 INTERNAL NOISE LEVELS

5.1.1 Environment noise break in

Noise data were taken and will be applied to all elevations.

Given the external noise levels, the initial glazing scheme can be suggested. However, it should be noted that this assumes windows closed in order to achieve the internal noise levels based on BS 8223:1999.

The amount of attenuation from the building façades were readily computed using the simple method in Appendix G of BS 8233:2014 whereby the sound insulation index (SRI) of the glazing (the weakest element of the building façade, acoustically) is determined by simply deducting the required internal noise level from the external free field noise level.

A -3dB façade correction was necessary as the noise monitoring was not free-field.

No distance attenuation required as noise monitoring was taken at the location of the eastern elevation, close to the existing noise sources.

There is no barrier correction due to direct line of sight to the noise sources.

The noise levels relate to the front elevation. Noise levels to the rear will be 10 dB less.

The weakest structural element is the glazing. The required glazing was calculated using recommended internal values. The Table below shows the required Sound Reduction Indices (SRI) for the bedrooms (night) and living areas (day) on each relevant elevation.

Façade	period	room	External Levels measured / calc'd		Internal Levels recommended		Required glazing	
			L_{Aeq} (dB)	L_{Amax} (dB)	L_{Aeq} (dB)	L_{Amax} (dB)	SRI ($R_w + C_{tr}$)	Example Spec ³
FRONT	night	bedroom	68	83	30	45	38	8 (20) 8.4A
	day	lounge	73		35		38	8 (20) 8.4A
REAR	night	bedroom	58	73	30	45	28	4 (12) 6
	day	lounge	63		35		28	4 (12) 6

Table 4
 Calculated SRI values and recommended glazing

Due to high noise level, there will need to be significant sound reduction from the acoustic glazing. For the front, it is recommended to use Saint Gobain double glazed unit with a build-up of 8 (20) 8.4A mm where

³ Example glazing build up and performance from Saint Gobain – table in Appendix. Other glazing build-ups available.



the 'A' denotes acoustic laminate. The rear still needs a slight upgrade from standard double-glazed unit, but not nearly as much as the front. For the rear windows, 4 (12) 6 mm Saint Gobain units would suffice.

5.1.2 Mechanical services noise

Noise in a habitable room due to the MVHR (Mechanical Ventilation with Heat Recovery) unit is determined by first knowing the sound power level of the inlets/outlets of the MVHR unit given in Figure 7. The MVHR system will vent to the outside for fresh intake air and to expel extract air.

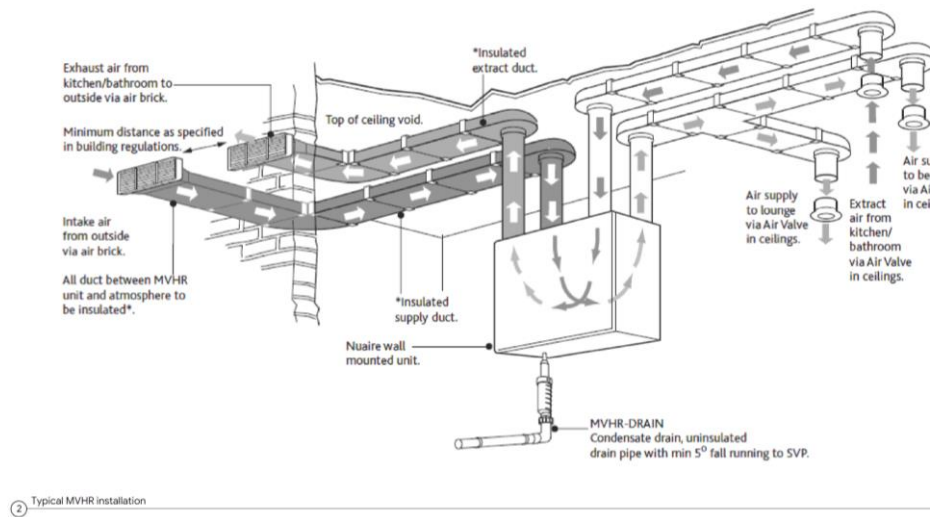


Figure 11
Typical MVHR system layout

The actual ventilation layout is shown in the figure below.



Figure 12
Ventilation layout



Noise levels will be calculated for both the internal outlets and external grilles. External noise due to the ventilation system shall be dealt with in the next Section.

The sound power at the grille is calculated using the following parameters:

- sound power of unit,
- length and type (circular or rectangular) of duct,
- branches (duct take offs),
- silencer attenuation and
- end reflection.

Once the sound power at the outlet (internal) grille is known then the reverberant sound pressure level in the room is determined using a modified version of Equation 5.5 from Woods [5].

$$SPL_{rev} = SWL_{grille} - 10 \log \left(\frac{A}{1 - \frac{A}{S}} \right) + 6 \quad (1)$$

where SWL_{grille} = sound power the outlet grille, dB

S = the surface area of the room, m²

A = is the equivalent absorption area of the receiving room being considered, m²

6 = diffuse to reverberant field correction.

Internal noise levels were calculated for the first-floor bedroom (nearest to MVHR units) and lounge, with noise levels for the unit operating at 100%, as a worst case scenario.

169A Kingsway, Burnage		Duct Calculation		First Floor Bedroom 2 - Boost		Octave band centre frequency							
Term	Quantity	Description	Details	63	125	250	500	1000	2000	4000	Total level		
L_w		Sound Power Level of unit	Kinetic BH (Acoustic Solution) - 100% L_w out	71.5	60.6	53.5	43.9	33.4	19.1	18.5	71.9		
	4.679 m	Duct Length in metres	Rectangular 150 x 150	-3.0	-3.0	-2.3	-1.6	-1.6	-1.6	-1.6			
	2	Number of bends	150mm round bend	0	0	-2	-4	-6	-6	-6			
	19800 mm	Branch area	10log(branch duct mm ² /main duct mm ²)	-3	-3	-3	-3	-3	-3	-3			
		Silencer attenuation (1)	no silencer or n/a	0	0	0	0	0	0	0			
		Silencer attenuation (2)	no silencer or n/a	0	0	0	0	0	0	0			
		Att due to end reflection	125 mm end reflection	-17	-12	-8	-4	-1	0	0			
		Louvre attenuation	no acoustic louvre or n/a	0	0	0	0	0	0	0			
		A weighting	yes	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0			
		Sound power at termination		22.2	26.4	29.6	28.1	21.8	9.7	8.9	33.6		
R_c		Room Constant	$R_c = A / [1 - (A/S)]$	-9.75	-11.44	-12.82	-13.63	-13.63	-13.23	-13.23			
	6	Numerical correction	$SPL = SWL - 10 \log R_c + 6$ (Eq 5.5 Woods)	6.00	6.00	6.00	6.00	6.00	6.00	6.00			
		SPL(A) at NSR	$L_{pA,NSR}$	18.5	21.0	22.7	20.4	14.1	2.4	1.6	27.2	dB	

Table 5
Calculation of the noise level in a bedroom due to mechanical services noise

The internal noise level for the nearest bedroom, due to duct noise from the MVHR unit, was 27.2 dB(A).

The process was repeated for the lounge.



169A Kingsway, Burnage		Duct Calculation	Lounge (First Floor)	Octave band centre frequency								
Term	Quantity	Description	Details	63	125	250	500	1000	2000	4000	Total level	
L_w		Sound Power Level of unit	Kinetic BH (Acoustic Solution) -100&_Lw out	71.5	60.6	53.5	43.9	33.4	19.1	18.5	71.9	
	5.592 m	Duct Length in metres	Rectangular 150 x 150	-3.6	-3.6	-2.8	-2.0	-2.0	-2.0	-2.0		
	1	Number of bends	150mm round bend	0	0	-1	-2	-3	-3	-3		
	19800 mm	Branch area	10log(branch+duct mm2/duct mm2)	-3	-3	-3	-3	-3	-3	-3		
		Silencer attenuation (1)	no silencer or n/a	0	0	0	0	0	0	0		
		Silencer attenuation (2)	no silencer or n/a	0	0	0	0	0	0	0		
		Att due to end reflection	125 mm end reflection	-17	-12	-8	-4	-1	0	0		
		Louvre attenuation	no acoustic louvre or n/a	0	0	0	0	0	0	0		
		A weighting	yes	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0		
		Sound power at termination		21.7	25.9	30.1	29.7	24.4	12.3	11.5	34.5	
R_c		Room Constant	$R_c = A / [1 - (A/S)]$	-9.32	-10.81	-11.98	-12.63	-12.63	-12.31	-12.31		
	6	Numerical correction	$SPL = SWL - 10logR_c + 6$ (Eq 5.5 Woods)	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
		SPL(A) at NSR	$L_{pA,NSR}$	18.3	21.0	24.1	23.1	17.8	6.0	5.2	28.6 dB	

Table 6
Mechanical noise to lounge

When the MVHR are running at 100% duty (i.e. overheating 'boost' mode), no additional mitigation will be required. The calculated noise limits are as follows:

Bedroom 27dB (Overheating Limit 35dB)

Lounge 29 dB (Overheating Limit 40dB).

5.2 EXTERNAL PLANT NOISE (VENTILATIONS GRILLES)

5.2.1 Calculation method

Noise from the ventilation external grilles needs to be assessed as 'external plant'. The sound power of the grille is calculated in the same way as in the previous section. However, noise is now being propagated externally and not into a room.

$$SPL_{ext} = SWL_{grille} - 20 \log r + DI(\theta) - 11 \quad (2)$$

where SWL_{grille} = sound power the outlet grille, dB

r = distance from grille to reception point, m.

θ = angle from grille to reception point,

11 = diffuse to reverberant field correction.

The method of determine the directivity index (DI) accounts for the area of the grille and the angle to the reception point. Page 98 of Woods [5] explains the method as the DI will also depend upon frequency.

As the grille will be located near to one surface (the rear elevation) then the following chart is referred to [Fig.11: 5]



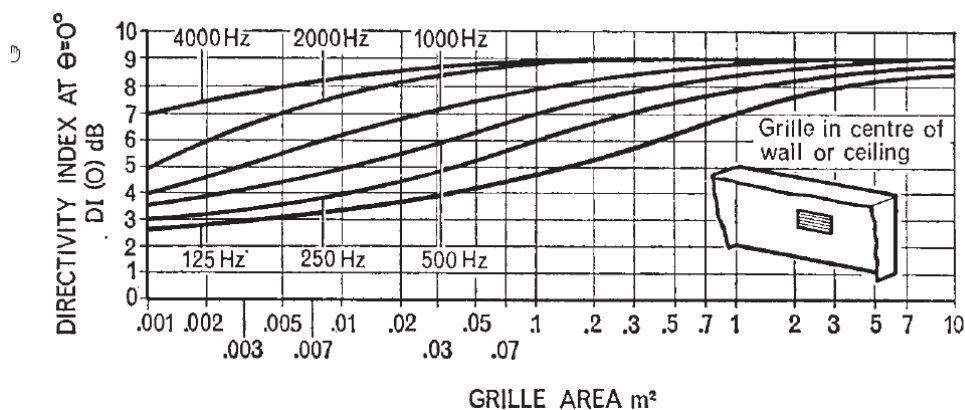


Figure 13

Values of Directivity Index for various grille sizes assuming only one reflective surface

The DI dB levels in Figure 13 are for on-axis. For off axis, the nearest whole dB value is used to find the actual dB attenuation at a particular angle, as shown in the table below.

Factor from Table 4.43	Directivity correction / dB at stated angle						
	0°	20°	40°	60°	80°	100°	120°
3	+3	+3	+3	+3	+3	+3	+3
4	+4	+4	+3	+3	+2	+2	0
5	+5	+5	+4	+3	+1	+2	-2
6	+6	+6	+4	+3	-1	-1	-6
7	+7	+6	+5	+2	-1	-4	-15
8	+8	+7	+5	+2	-4	-13	-30
9	+9	+8	+6	0	-30	-30	-30

Table 7

dB attenuation for off axis angle given on axis dB rating (3 – 9)

If the reception point is at a façade, then a 3dB addition is factored in.

5.2.2 Background Noise Levels

In order to determine the 'typical' background noise levels at the front for the night (most noise sensitive period), a histogram were plotted for the broadband L_{A90} 15-minute levels.



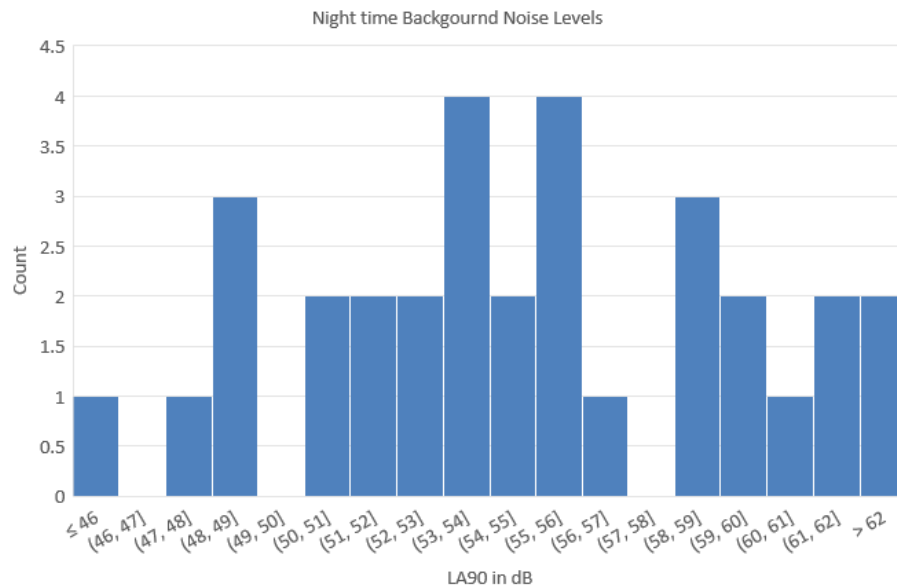


Figure 14
histogram of L_{A90} values - night

The lowest typical background noise level at the front for the night time period was 53dB L_{A90} .

5.2.3 Assessment

The grille has the following dimensions:

width 0.22m

height 0.09m

The nearest habitable window will be a approximately 0.5 m from the nearest grille, which is approximately 80deg from the grille.

169A Kingsway, Burnage		Duct Calculation	External intake	Octave band centre frequency								
Term	Quantity	Description	Details	63	125	250	500	1000	2000	4000	Total level	
L_w		Sound Power Level of unit	Kinetic BH (Acoustic Solution) - 100&_Lw in	77.3	70.8	64.9	53.8	41.4	26.3	21.9	78.4	
	2.94 m	Duct Length in metres	Rectangular 150 x 150	-1.9	-1.9	-1.5	-1.0	-1.0	-1.0	-1.0		
	0	Number of bends	150mm round bend	0	0	0	0	0	0	0		
	12240 mm	Branch area	10log(branch+duct mm2/duct mm2)	-3	-3	-3	-3	-3	-3	-3		
		Silencer attenuation (1)	no silencer or n/a	0	0	0	0	0	0	0		
		Silencer attenuation (1)	PVCSIL-1000	1	0	-11	-12	-13	-37	-23		
		Att due to end reflection	250 mm end reflection	-12	-8	-4	-1	0	0	0		
		Louvre attenuation	no acoustic louvre or n/a	0	0	0	0	0	0	0		
		A weighting	yes	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0		
		Sound power at termination	A weighted	35.2	41.8	36.8	33.6	24.4	-13.5	-4.1	44.1	
r	1 m	Distance attenuation	20*log10(r)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Q	1	Reflections - additional surface(s)?	0 surfaces	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
DI		Directivity - area of and angle from grille	0.05m2 @ 80° - 1 surface	3	2	1	-1	-1	-4	-4		
	-11	Numerical correction	SPL = SWL -20log(r) + DI(theta) - 11	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00		
	3	façade correction	yes	3.00	3.00	3.00	3.00	3.00	3.00	3.00		
		SPL(A) at NSR	$L_{pA,NSR}$	30.2	35.8	29.8	24.6	15.4	0.0	0.0	37.9 dB	

Table 8
Calculation for external noise level from intake grille

The broadband noise level of 38 dB(A) is used for a BS4142 assessment using the night time (worst case) typical background noise level (see Section 5.2.2).



NB The above noise level includes a Nuaire PVCSIL-1000 rectangular silencer on the atmosphere side of the fan. Full details of which are given in the Appendix.**

For the BS 4142 assessment, there is a penalty for tonality as well as intermittency.

BS 4142 Noise Assessment (external exhaust)	Value	dB
Total Specific Noise Level @ NSR		38
BS 4141		
Tonality	0/2/4/4	2
Impulsivity	0/3/6/9	0
Intermittency	0/3	3
Rating Noise Level		43
Background Noise Level		53
Rating minus Background	✓	-10

Table 9
BS 4142 Assessment for external exhaust at night

Table 9 clearly shows that the Rating Level from the external grille(s) of the ventilation system are well below the Background Level and thus compliant with the Council's noise requirements.

6 CONCLUSION

An acoustic survey has taken place at 169 Kingsway, Burnage to support a planning application for an additional residential dwelling.

The main issue of noise was passing vehicles on Kingsway which resulted in high noise levels. Noise levels to the rear are typically 10dB less for road noise.

The assessment revealed that upgraded double glazed windows are required for both the front and rear. Internal noise levels can be achieved with Saint Gobain of 8 (20) 8.4A mm acoustic laminated units for the front and 4 (12) 6 mm Saint Gobain units to the rear.

A whole house ventilation system has now been proposed and assessed. Internal and external noise assessments have revealed that suitable noise levels can be achieved without additional mitigation. However, there should be silencers just before the grilles, as shown in the ventilation layout drawing.

A alternative ventilation scheme has been proposed that obviates the need to open a window and thus, increasing internal noise levels above permitted acoustic thresholds.

7 REFERENCES

- [1] BS8233: 2014
Guidance on sound insulation and noise reduction for buildings
British Standards Institute, 2014.
- [2] BS 4142: 1997
Method for Rating industrial noise affecting mixed residential and industrial areas
British Standards Institute, 1997.



- [3] BS 4142: 2014
Methods for rating and assessing industrial and commercial sound
British Standards Institute, 2014.
- [4] Environmental Protection
Planning & Noise - Technical Guidance
Manchester City Council, Dec 2015.
- [5] Ian Sharland
FLÄKT WOODS PRACTICAL GUIDE TO NOISE CONTROL
Fläkt Woods Limited, Colchester, England, 2005.



Appendix

A1 Saint Gobain – Glazing spec

								
Glass	Thicknes	Laborato	Year	Test Numb	Rw	Rw+(	Rw+C	R (C;Ct)
4 (20) 4	28	CDI	2001	625985	30	30	26	30(-0;-4)
4 (10) 4	18	CDI	1999		30	29	27	30(-1;-3)
4 (12) 4	20	CDI	1992		30	30	27	30(-0;-3)
4 (15) 4	23	CDI	2002		32	31	27	32(-1;-5)
4 (16) 4	24	CDI	2008	701325	30	29	27	30(-1;-3)
5 (12) 5	22	CDI	1998		32	31	28	32(-1;-4)
4 (6) 4	14	CDI	1998		31	31	29	31(-0;-2)
4 (6) 5	15	CDI	2002		31	31	29	31(-0;-2)
4 (15) 5	24	CDI	2006		34	33	29	34(-1;-5)
4 (12) 6	22	CDI	2004		33	32	29	33(-1;-4)
5 (6) 5	16	CDI	2006		32	32	29	32(-0;-3)

								
Glass	Thicknes	Laborato	Year	Test Numb	Rw	Rw+(	Rw+C	R (C;Ct)
8 (20) 8.4A	36	CDI	2006		43	42	38	43(-1;-5)
12 (16) 8.4A	36	CDI	2005		43	42	38	43(-1;-5)
8.4A (16Arg) 10.4A	35	CDI	2001		45	43	38	45(-2;-7)
8 (16) 10.4A	34	CDI	2005		43	42	38	43(-1;-5)
8.8A (16Arg) 64.2A	36	CDI	1999		44	42	38	44(-2;-6)
10 (16argon) 66.3	39	APU	1999		41	40	38	41(-1;-3)
14.8 (16) 1010.2	52	CDI	1998		44	43	38	44(-1;-6)
10.8 (12) 8.4A	31	CDI	2002		43	42	38	43(-1;-5)
10.4 (16) 8.4A	35	CDI	2001		44	42	38	44(-2;-6)
8.8 A (12) 10.8 A (64.2)	31	CDI	2004	627089	42	41	38	42(-1;-4)



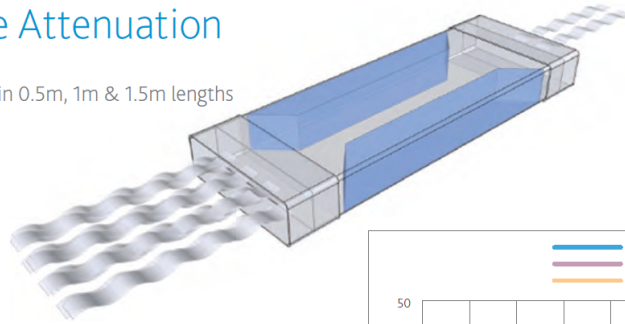
A2 VENTILATION SILENCER

NUAIRE'S NOISE SOLUTIONS



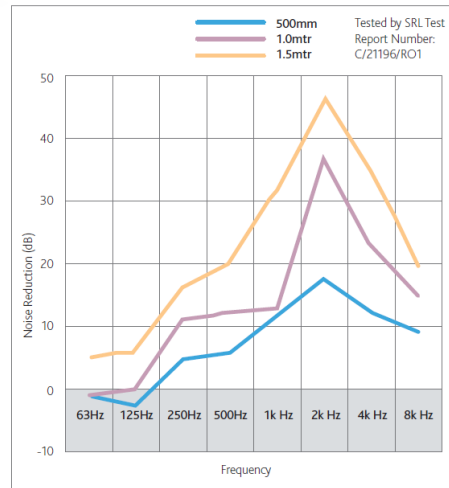
Inline Attenuation

Available in 0.5m, 1m & 1.5m lengths



Features

- Regulation driven to reduce duct noise for designers "Domestic Compliance Guide 2010" & noise requirements Part F 2010
- Corrosion Proof - Lightweight PVC removes the risk of corrosion
- Reduce cross talk room to room noise
- Prevents noise ingress for inner city development
- Space Saving - Slim line low profile design for integration within your ducting system



PRODUCT RANGE

Silencer Code	Description	Width	Length	Height
PVCSIL-500	System 204 Duct Silencer x 500mm	204mm	580mm	65mm
PVCSIL-1000	System 204 Duct Silencer x 1.0mtr	204mm	1080mm	65mm
PVCSIL-1500	System 204 Duct Silencer x 1.5mtr	204mm	1580mm	65mm

THE LEVEL OF SOUND ABSORPTION

Silencer Length	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
500mm	-3	5	6	12	18	12	9
1.0mtr	0	11	12	13	37	23	15
1.5mtr	6	16	20	32	47	35	20

STATIC PRESSURE DROP IN PASCALS (PA) VERSUS FLOW RATE (L/S)

Approximate l/s		15	30	60	90	120	150
PVCSIL-500	pa	10.5	18.5	100	213	371	576
PVCSIL-1000	pa	10.4	17.2	107	234	373	578
PVCSIL-1500	pa	8.2	23.5	107	230	412	595

75

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